Agilent 1260 Infinity Variable Wavelength Detector

User Manual

Agilent Technologies

Notices

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In This Manual...

This manual covers the Agilent 1260 Infinity Variable Wavelength Detectors

G1314B	Agilent 1260 Infinity Variable Wavelength Detector VL
G1314C	Agilent 1260 Infinity Variable Wavelength Detector VL+

1 Introduction to the Variable Wavelength Detector

This chapter gives an introduction to the detector, instrument overview and internal connectors.

2 Site Requirements and Specifications

This chapter gives information on environmental requirements, physical and performance specifications.

3 Installing the Detector

This chapter provides information on unpacking, checking on completeness, stack considerations and installation of the module.

4 Using the Detector

This chapter provides information on how to set up the detector for an analysis and explains the basic settings.

5 How to optimize the detector

This chapter gives hints on how to select the detector parameters and the flow cell.

6 Troubleshooting and Diagnostics

This chapter describes the detector's built in diagnostic signals.

7 Error Information

This chapter describes the meaning of detector error messages, and provides information on probable causes and suggested actions how to recover from error conditions.

8 Test Functions

This chapter describes the detector's built in test functions.

9 Maintenance and Repair

This chapter provides general information on maintenance and repair of the detector.

10 Maintenance

This chapter describes the maintenance of the detector.

11 Parts and Materials for Maintenance

This chapter provides information on parts for maintenance.

12 Identifying Cables

This chapter provides information on cables used with the Agilent 1260 Infinity modules.

A Appendix

This chapter provides addition information on safety, legal and web.

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This chapter gives an introduction to the detector, instrument overview and internal connectors.

Introduction to the Detector

The Agilent 1260 Infinity Variable Wavelength Detector is designed for highest optical performance, GLP compliance and easy maintenance with:

- data rate up to
  - 13 Hz for standard HPLC with G1314B VWD VL and
  - 55 Hz for fast-HPLC with G1314C VWD VL+,
- deuterium lamp for highest intensity and lowest detection limit over a wavelength range of 190 to 600 nm,
- optional flow-cell cartridges (standard 10 mm 14 µL, high pressure 10 mm 14 µL, micro 5 mm 1 µL, semi-micro 6 mm 5 µL) are available and can be used depending on the application needs,
- easy front access to lamp and flow cell for fast replacement, and
- built-in holmium oxide filter for fast wavelength accuracy verification.

For specifications “Performance Specifications" on page 43.

Two versions of the Agilent 1260 Infinity Variable Wavelength Detector are available:

G1314B	Agilent 1260 Infinity Variable Wavelength Detector VL standard version
G1314C	Agilent 1260 Infinity Variable Wavelength Detector VL+ high data rates for fast HPLC

Optical System Overview

The optical system of the detector is shown in Figure 1. Its radiation source is a deuterium-arc discharge lamp for the ultraviolet (UV) wavelength range from 190 to 600 nm. The light beam from the deuterium lamp passes through a lens, a filter assembly (in position none, cut-off or holmium oxide), an entrance slit, a spherical mirror (M1), a grating, a second spherical mirror (M2), a beam splitter, and finally through a flow cell to the sample diode. The beam through the flow cell is absorbed depending on the solutions in the cell, in which UV absorption takes place, and the intensity is converted to an electrical signal by means of the sample photodiode. Part of the light is directed to the reference photodiode by the beam splitter to obtain a reference signal for compensation of intensity fluctuation of the light source. A slit in front of the reference photodiode cuts out light of the sample bandwidth. Wavelength selection is made by rotating the grating, which is driven directly by a stepper motor. This configuration allows fast change of the wavelength. The cutoff filter is moved into the lightpath above 370 nm to reduce higher order light.

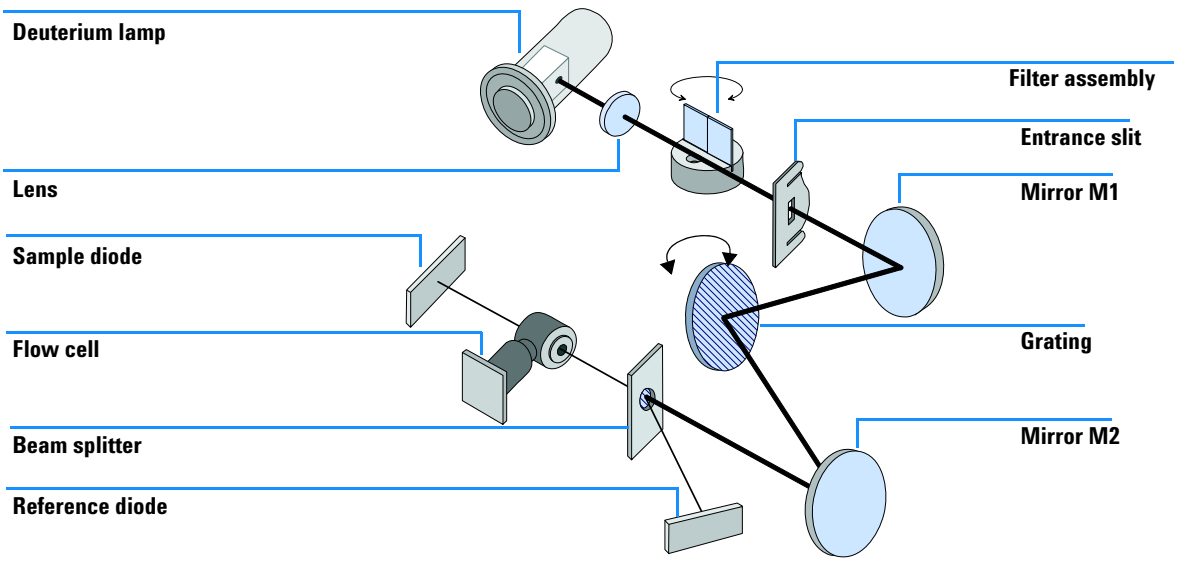


Figure 1 Optical Path of the Variable Wavelength Detector

Flow Cell

A variety of flow-cell cartridges can be inserted using the same quick and simple mounting system.

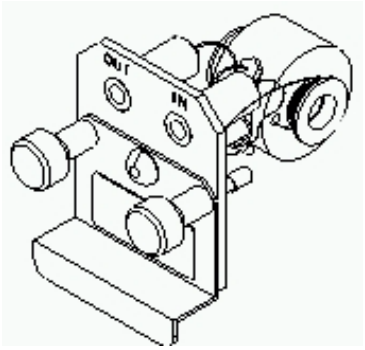


Figure 2 Cartridge Type Flow Cell

Table 1 Flow Cell Data

	STD	Semi-micro	High Pressure	Micro	
Maximum pressure	40 (4)	40 (4)	400 (40)	40 (4)	bar (MPa)
Path length	10 (conical)	6 (conical)	10 (conical)	5	mm
Volume	14	5	14	1	µL
Inlet i.d.	0.17	0.17	0.17	0.1	mm
Inlet length	750	750	750	555	mm
Outlet i.d.	0.25	0.25	0.25	0.25	mm
Outlet length	120	120	120	120	mm
Materials in contact with solvent	SST, quartz, PTFE, PEEK	SST, quartz, PTFE	SST, quartz, Kapton	SST, quartz, PTFE	

Lamp

The light source for the UV wavelength range is a deuterium lamp. As a result of plasma discharge in a low pressure deuterium gas, the lamp emits light over the 190 to 600 nm wavelength range.

Source Lens Assembly

The source lens receives the light from the deuterium lamp and focuses it onto the entrance slit.

Entrance Slit Assembly

The entrance slit assembly has an exchangeable slit. The standard one has a 1-mm slit. For replacement and calibration purposes to optimize the alignment, a slit with a hole is needed.

Filter Assembly

The filter assembly is electromechanically actuated. During wavelength calibrations it moves into the light path.

The filter assembly has two filters installed and is processor-controlled.

OPEN	**nothing in light path**
CUTOFF	**cut off filter in light path at $\lambda > 370$ nm**
HOLMIUM	**holmium oxide filter for wavelength check.**

A photo sensor determines the correct position.

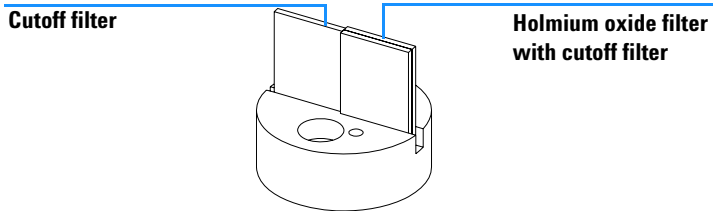


Figure 3 Filter Assembly

Mirror Assemblies M1 and M2

The instrument contains two spherical mirrors (M1 and M2). The beam adjustable is vertically and horizontally. Both mirrors are identical.

Grating Assembly

The grating separates the light beam into all its component wavelengths and reflects the light onto mirror #2.

Beam Splitter Assembly

The beam splitter splits the light beam. One part goes directly to the sample diode. The other part of the light beam goes to the reference diode.

Photo Diodes Assemblies

Two photo diode assemblies are installed in the optical unit. The sample diode assembly is located on the left side of the optical unit. The reference diode assembly is located in the front of the optical unit.

Photo Diode ADC (analog-to-digital converter)

The photo diode current is directly converted to 20-bit digital data direct photo current digitalization. The data is transferred to the detector main board (VWM). The photo diode ADC boards are located close to the photo diodes.

Electrical Connections

- The CAN bus is a serial bus with high speed data transfer. The two connectors for the CAN bus are used for internal module data transfer and synchronization.
- One analog output provides signals for integrators or data handling systems.
- The interface board slot is used for external contacts and BCD bottle number output or LAN connections.
- The REMOTE connector may be used in combination with other analytical instruments from Agilent Technologies if you want to use features such as start, stop, common shut down, prepare, and so on.
- With the appropriate software, the RS-232C connector may be used to control the module from a computer through a RS-232C connection. This connector is activated and can be configured with the configuration switch.
- The power input socket accepts a line voltage of 100 – 240 volts AC ± 10% with a line frequency of 50 or 60 Hz. Maximum power consumption is 220 VA. There is no voltage selector on your module because the power supply has wide-ranging capability. There are no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

NOTE Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations

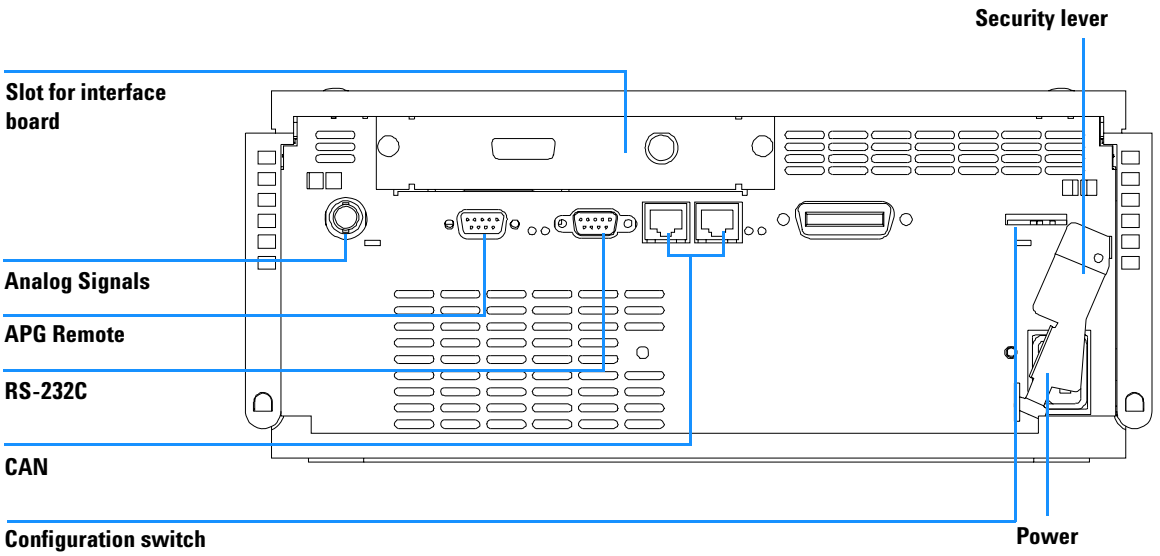


Figure 4 Rear View of Detector

NOTE The GPIB interface has been removed with the introduction of the 1260 Infinity modules.

Serial Number Information

Serial Number Information 1260 Infinity

The serial number information on the instrument labels provide the following information:

CCXZZ00000	Format
CC	Country of manufacturing (DE Germany)
X	Alphabetic character A-Z (used by manufacturing)
ZZ	Alpha-numeric code 0-9, A-Z, where each combination unambiguously denotes a module (there can be more than one code for the same module)
00000	Serial number

Serial Number Information 1200 Series

The serial number information on the instrument labels provide the following information:

CCYWW00000	Format
CC	Country of manufacturing (DE Germany)
YWW	year and week of last major manufacturing change, e.g. 820 could be week 20 of 1998 or 2008
00000	Serial number

Instrument Layout

The industrial design of the module incorporates several innovative features. It uses Agilent's E-PAC concept for the packaging of electronics and mechanical assemblies. This concept is based upon the use of expanded polypropylene (EPP) layers foam plastic spacers in which the mechanical and electronic boards components of the module are placed. This pack is then housed in a metal inner cabinet which is enclosed by a plastic external cabinet. The advantages of this packaging technology are:

- virtual elimination of fixing screws, bolts or ties, reducing the number of components and increasing the speed of assembly/disassembly,
- the plastic layers have air channels molded into them so that cooling air can be guided exactly to the required locations,
- the plastic layers help cushion the electronic and mechanical parts from physical shock, and
- the metal inner cabinet shields the internal electronics from electromagnetic interference and also helps to reduce or eliminate radio frequency emissions from the instrument itself.

Early Maintenance Feedback (EMF)

Maintenance requires the exchange of components which are subject to wear or stress. Ideally, the frequency at which components are exchanged should be based on the intensity of usage of the instrument and the analytical conditions, and not on a predefined time interval. The early maintenance feedback (EMF) feature monitors the usage of specific components in the instrument, and provides feedback when the user-selectable limits have been exceeded. The visual feedback in the user interface provides an indication that maintenance procedures should be scheduled.

EMF Counter

The detector module provides a EMF counter for the lamp. The counter increments with lamp use, and can be assigned a maximum limit which provides visual feedback in the user interface when the limit is exceeded. The counter can be reset to zero after the lamp is exchanged. The detector provides the following EMF counters:

- Deuterium Lamp On-Time

Using the EMF Counters

The user-settable EMF limits for the EMF counter enables the early maintenance feedback to be adapted to specific user requirements. The useful lamp burn time is dependent on the requirements for the analysis (high or low sensitivity analysis, wavelength, and so on), therefore, the definition of the maximum limits need to be determined based on the specific operating conditions of the instrument.

Setting the EMF Limits

The setting of the EMF limits must be optimized over one or two maintenance cycles. Initially, no EMF limit should be set. When instrument performance indicates maintenance is necessary, take note of the values displayed by lamp counters. Enter these values (or values slightly less than the displayed values) as EMF limits, and then reset the EMF counters to zero. The next time the EMF counters exceed the new EMF limits, the EMF flag will be displayed, providing a reminder that maintenance needs to be scheduled.

Interfaces

The Agilent 1200 Infinity Series modules provide the following interfaces:

Table 2 Agilent 1200 Infinity Series Interfaces

Module	CAN	LAN/BCD (optional)	LAN (on-board)	RS-232	Analog	APG Remote	Special
Pumps							
G1310B Iso Pump G1311B Quat Pump G1311C Quat Pump VL G1312B Bin Pump G1312C Bin Pump VL 1376A Cap Pump G2226A Nano Pump	2	Yes	No	Yes	1	Yes	
G4220A/B Bin Pump	2	No	Yes	Yes	No	Yes	
G1361A Prep Pump	2	Yes	No	Yes	No	Yes	CAN-DC- OUT for CAN slaves
Samplers							
G1329B ALS G2260A Prep ALS	2	Yes	No	Yes	No	Yes	THERMOSTAT for G1330B
G1364B FC-PS G1364C FC-AS G1364D FC-µS G1367E HiP ALS G1377A HiP micro ALS G2258A DL ALS	2	Yes	No	Yes	No	Yes	THERMOSTAT for G1330B CAN-DC- OUT for CAN slaves
G4226A ALS	2	Yes	No	Yes	No	Yes	
Detectors							
G1314B VWD VL G1314C VWD VL+	2	Yes	No	Yes	1	Yes	
G1314E/F VWD	2	No	Yes	Yes	1	Yes	

Table 2 Agilent 1200 Infinity Series Interfaces

Module	CAN	LAN/BCD (optional)	LAN (on-board)	RS-232	Analog	APG Remote	Special
G4212A/B DAD	2	No	Yes	Yes	1	Yes	
G1315C DAD VL+ G1365C MWD G1315D DAD VL G1365D MWD VL	2	No	Yes	Yes	2	Yes	
G1321B FLD G1362A RID	2	Yes	No	Yes	1	Yes	
G4280A ELSD	No	No	No	Yes	Yes	Yes	EXT Contact AUTOZERO
Others							
G1316A/C TCC	2	No	No	Yes	No	Yes	
G1322A DEG	No	No	No	No	No	Yes	AUX
G1379B DEG	No	No	No	Yes	No	No	AUX
G4227A Flex Cube	2	No	No	No	No	No	
G4240A CHIP CUBE	2	Yes	No	Yes	No	Yes	CAN-DC- OUT for CAN slaves THERMOSTAT for G1330A/B (NOT USED)

NOTE The detector (DAD/MWD/FLD/VWD/RID) is the preferred access point for control via LAN. The inter-module communication is done via CAN.

- CAN connectors as interface to other modules
- LAN connector as interface to the control software
- RS-232C as interface to a computer
- REMOTE connector as interface to other Agilent products
- Analog output connector(s) for signal output

Overview Interfaces

CAN

The CAN is inter-module communication interface. It is a 2-wire serial bus system supporting high speed data communication and real-time requirement.

LAN

The modules have either an interface slot for an LAN card (e.g. Agilent G1369A/B LAN Interface) or they have an on-board LAN interface (e.g. detectors G1315C/D DAD and G1365C/D MWD). This interface allows the control of the module/system via a connected PC with the appropriate control software.

NOTE If an Agilent detector (DAD/MWD/FLD/VWD/RID) is in the system, the LAN should be connected to the DAD/MWD/FLD/VWD/RID (due to higher data load). If no Agilent detector is part of the system, the LAN interface should be installed in the pump or autosampler.

RS-232C (Serial)

The RS-232C connector is used to control the module from a computer through RS-232C connection, using the appropriate software. This connector can be configured with the configuration switch module at the rear of the module. Refer to "Communication Settings for RS-232C" on page 32.

NOTE There is no configuration possible on main boards with on-board LAN. These are pre-configured for

- 19200 baud,
- 8 data bit with no parity and

one start bit and one stop bit are always used (not selectable).

The RS-232C is designed as DCE (data communication equipment) with a 9-pin male SUB-D type connector. The pins are defined as:

Table 3 RS-232C Connection Table

Pin	Direction	Function
1	In	DCD
2	In	RxD
3	Out	TxD
4	Out	DTR
5		Ground
6	In	DSR
7	Out	RTS
8	In	CTS
9	In	RI

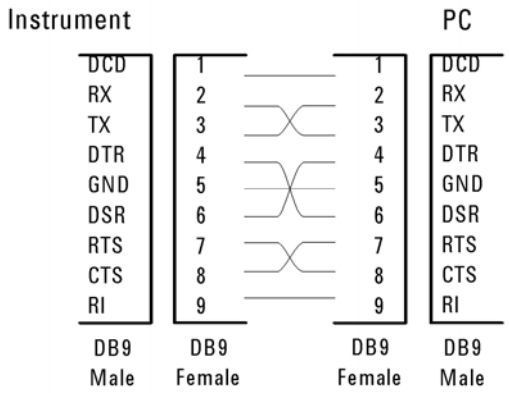


Figure 5 RS-232 Cable

Analog Signal Output

The analog signal output can be distributed to a recording device. For details refer to the description of the module's main board.

APG Remote

The APG Remote connector may be used in combination with other analytical instruments from Agilent Technologies if you want to use features as common shut down, prepare, and so on.

Remote control allows easy connection between single instruments or systems to ensure coordinated analysis with simple coupling requirements.

The subminiature D connector is used. The module provides one remote connector which is inputs/outputs (wired- or technique).

To provide maximum safety within a distributed analysis system, one line is dedicated to **SHUT DOWN** the system's critical parts in case any module detects a serious problem. To detect whether all participating modules are switched on or properly powered, one line is defined to summarize the **POWER ON** state of all connected modules. Control of analysis is maintained by signal readiness **READY** for next analysis, followed by **START** of run and optional **STOP** of run triggered on the respective lines. In addition **PREPARE** and **START REQUEST** may be issued. The signal levels are defined as:

- standard TTL levels (0 V is logic true, + 5.0 V is false),
- fan-out is 10,
- input load is 2.2 kOhm against + 5.0 V, and
- output are open collector type, inputs/outputs (wired- or technique).

NOTE All common TTL circuits operate with a 5 V power supply. A TTL signal is defined as "low" or L when between 0 V and 0.8 V and "high" or H when between 2.0 V and 5.0 V (with respect to the ground terminal).

Table 4 Remote Signal Distribution

Pin	Signal	Description
1	DGND	Digital ground
2	PREPARE	(L) Request to prepare for analysis (for example, calibration, detector lamp on). Receiver is any module performing pre-analysis activities.
3	START	(L) Request to start run / timetable. Receiver is any module performing run-time controlled activities.
4	SHUT DOWN	(L) System has serious problem (for example, leak: stops pump). Receiver is any module capable to reduce safety risk.
5		Not used
6	POWER ON	(H) All modules connected to system are switched on. Receiver is any module relying on operation of others.
7	READY	(H) System is ready for next analysis. Receiver is any sequence controller.
8	STOP	(L) Request to reach system ready state as soon as possible (for example, stop run, abort or finish and stop injection). Receiver is any module performing run-time controlled activities.
9	START REQUEST	(L) Request to start injection cycle (for example, by start key on any module). Receiver is the autosampler.

Special Interfaces

Some modules have module specific interfaces/connectors. They are described in the module documentation.

Setting the 8-bit Configuration Switch

Setting the 8-bit Configuration Switch (On-Board LAN)

The 8-bit configuration switch is located at the rear of the module. Switch settings provide configuration parameters for LAN, serial communication protocol and instrument specific initialization procedures.

All modules with on-board LAN, e.g. G1315/65C/D, G1314D/E/F, G4212A/B, G4220A:

- Default is ALL switches DOWN (best settings) - Bootp mode for LAN.
- For specific LAN modes switches 3-8 must be set as required.
- For boot/test modes switches 1+2 must be UP plus required mode.

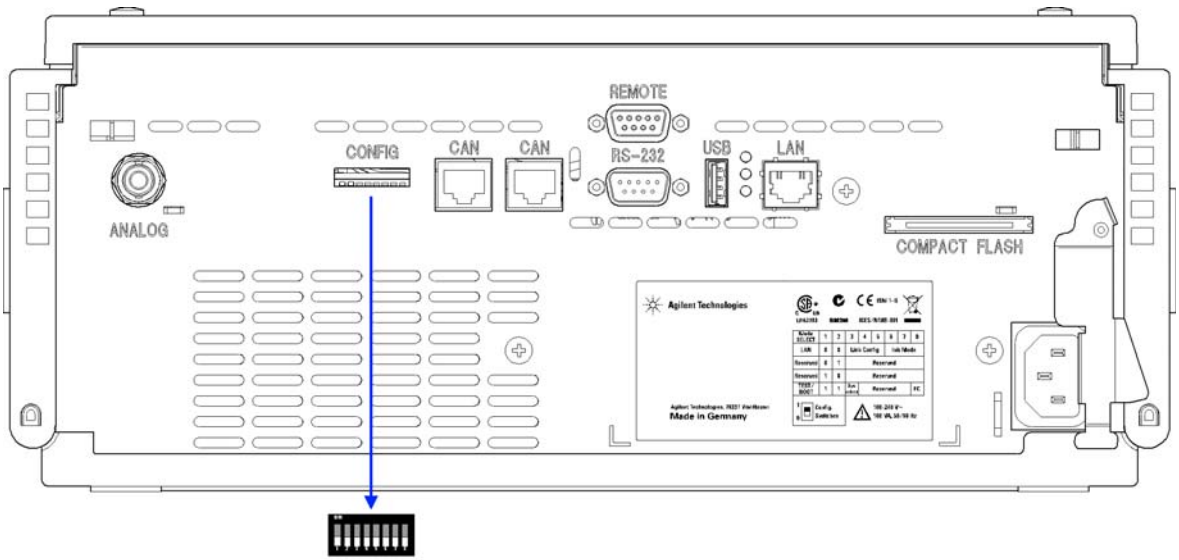


Figure 6 Location of Configuration Switch (example shows a G4212A DAD)

NOTE To perform any LAN configuration, SW1 and SW2 must be set to OFF. For details on the LAN settings/configuration refer to chapter LAN Configuration.

Table 5 8-bit Configuration Switch (with on-board LAN)

	Mode		Function					
	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8
LAN	0	0	Link Configuration			Init Mode Selection		
Auto-negotiation			0	x	x	x	x	x
10 MBit, half-duplex			1	0	0	x	x	x
10 MBit, full-duplex			1	0	1	x	x	x
100 MBit, half-duplex			1	1	0	x	x	x
100 MBit, full-duplex			1	1	1	x	x	x
Bootp			x	x	x	0	0	0
Bootp & Store			x	x	x	0	0	1
Using Stored			x	x	x	0	1	0
Using Default			x	x	x	0	1	1
TEST	1	1	System					NVRAM
Boot Resident System			1					x
Revert to Default Data (Coldstart)			x	x	x			1

Legend:

0 (switch down), 1 (switch up), x (any position)

NOTE When selecting the mode TEST, the LAN settings are: Auto-Negotiation & Using Stored.

NOTE For explanation of "Boot Resident System" and "Revert to Default Data (Coldstart)" refer to "Special Settings" on page 34

Setting the 8-bit Configuration Switch (without On-Board LAN)

The 8-bit configuration switch is located at the rear of the module.

Modules that do not have their own LAN interface (e.g. the TCC) can be controlled through the LAN interface of another module and a CAN connection to that module.

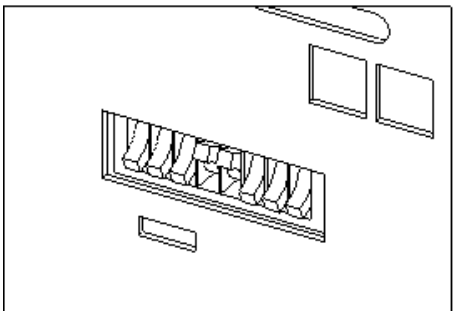


Figure 7 Configuration switch (settings depend on configured mode)

All modules without on-board LAN:

- default is ALL DIPS DOWN (best settings) - Bootp mode for LAN
- for boot/test modes DIPS 1+2 must be UP plus required mode

Switch settings provide configuration parameters for GPIB address, serial communication protocol and instrument specific initialization procedures.

NOTE With the introduction of the Agilent 1260 Infinity, all GPIB interfaces have been removed. The preferred communication is LAN.

NOTE The following tables represent the configuration switch settings for the modules without on-board LAN only.

Table 6 8-bit Configuration Switch (without on-board LAN)

Mode Select	1	2	3	4	5	6	7	8
RS-232C	0	1	Baudrate			Data Bits	Parity	
Reserved	1	0	Reserved					
TEST/BOOT	1	1	RSVD	SYS		RSVD	RSVD	FC

NOTE The LAN settings are done on the LAN Interface Card G1369A/B. Refer to the documentation provided with the card.

Communication Settings for RS-232C

The communication protocol used in the column compartment supports only hardware handshake (CTS/RTR).

Switches 1 in down and 2 in up position define that the RS-232C parameters will be changed. Once the change has been completed, the column instrument must be powered up again in order to store the values in the non-volatile memory.

Table 7 Communication Settings for RS-232C Communication (without on-board LAN)

Mode Select	1	2	3	4	5	6	7	8
RS-232C	0	1	Baudrate			Data Bits	Parity	

Use the following tables for selecting the setting which you want to use for RS-232C communication. The number 0 means that the switch is down and 1 means that the switch is up.

Table 8 Baudrate Settings (without on-board LAN)

Switches			Baud Rate	Switches			Baud Rate
3	4	5		3	4	5	
0	0	0	9600	1	0	0	9600
0	0	1	1200	1	0	1	14400
0	1	0	2400	1	1	0	19200
0	1	1	4800	1	1	1	38400

Table 9 Data Bit Settings (without on-board LAN)

Switch 6	Data Word Size
0	7 Bit Communication
1	8 Bit Communication

Table 10 Parity Settings (without on-board LAN)

Switches		Parity
7	8	
0	0	No Parity
1	0	Odd Parity
1	1	Even Parity

One start bit and one stop bit are always used (not selectable).

Per default, the module will turn into 19200 baud, 8 data bit with no parity.

Special Settings

The special settings are required for specific actions (normally in a service case).

NOTE The tables include both settings for modules – with on-board LAN and without on-board LAN. They are identified as LAN and no LAN.

Boot-Resident

Firmware update procedures may require this mode in case of firmware loading errors (main firmware part).

If you use the following switch settings and power the instrument up again, the instrument firmware stays in the resident mode. It is not operable as a module. It only uses basic functions of the operating system for example, for communication. In this mode the main firmware can be loaded (using update utilities).

Table 11 Boot Resident Settings (without on-board LAN)

	Mode Select	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
LAN	TEST/BOOT	1	1	1	0	0	0	0	0
No LAN	TEST/BOOT	1	1	0	0	1	0	0	0

Forced Cold Start

A forced cold start can be used to bring the module into a defined mode with default parameter settings.

CAUTION

Loss of data

Forced cold start erases all methods and data stored in the non-volatile memory. Exceptions are diagnosis and repair log books which will not be erased.

→ Save your methods and data before executing a forced cold start.

If you use the following switch settings and power the instrument up again, a forced cold start has been completed.

Table 12 Forced Cold Start Settings (without on-board LAN)

	Mode Select	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
LAN	TEST/BOOT	1	1	0	0	0	0	0	1
No LAN	TEST/BOOT	1	1	0	0	1	0	0	1

2
Site Requirements and Specifications

Site Requirements 38
Physical Specifications 42
Performance Specifications 43

This chapter gives information on environmental requirements, physical and performance specifications.

Site Requirements

A suitable environment is important to ensure optimal performance of the module.

Power Consideration

The module power supply has wide ranging capabilities (see Table 13 on page 42). It accepts any line voltage in the above mentioned range. Consequently, there is no voltage selector in the rear of the module. There are also no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

WARNING

Module is partially energized when switched off, as long as the power cord is plugged in.

Repair work at the module can lead to personal injuries, e.g. shock hazard, when the cover is opened and the module is connected to power.

→ Make sure that it is always possible to access the power plug.

→ Remove the power cable from the instrument before opening the cover.

→ Do not connect the power cable to the Instrument while the covers are removed.

WARNING

Incorrect line voltage at the module

Shock hazard or damage of your instrument can result if the devices are connected to line voltage higher than specified.

→ Connect your module to the specified line voltage.

CAUTION

Unaccessable power plug.

In case of emergency it must be possible to disconnect the instrument from the power line at any time.

→ Make sure the power connector of the instrument can be easily reached and unplugged.

→ Provide sufficient space behind the power socket of the instrument to unplug the cable.

Power Cords

Different power cords are offered as options with the module. The female end of the power cords is identical. It plugs into the power-input socket at the rear of the module. The male end of each power cord is different and designed to match the wall socket of a particular country or region.

WARNING

Absence of ground connection or use of unspecified power cord

The absence of ground connection or the use of unspecified power cord can lead to electric shock or short circuit.

→ Never operate your instrumentation from a power outlet that has no ground connection.

→ Never use a power cord other than the Agilent Technologies power cord designed for your region.

WARNING

Use of unsupplied cables

Using cables not supplied by Agilent Technologies can lead to damage of the electronic components or personal injury.

→ Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.

WARNING

Unintended use of supplied power cords

Using power cords for unintended purposes can lead to personal injury or damage of electronic equipment.

→ Never use the power cords that Agilent Technologies supplies with this instrument for any other equipment.

Bench Space

The module dimensions and weight (see Table 13 on page 42) allow to place the instrument on almost any desk or laboratory bench. It needs an additional 2.5 cm (1.0 inch) of space on either side and approximately 8 cm (3.1 inches) in the rear for air circulation and electric connections.

If the bench should carry an Agilent system, make sure that the bench is designed to bear the weight of all modules.

The detector should be operated in a horizontal position.

Environment

Your module will work within specifications at ambient temperatures and relative humidity as described in Table 13 on page 42.

ASTM drift tests require a temperature change below 2 °C/hour (3.6 °F/hour) measured over one hour period. Our published drift specification (refer also to "Performance Specifications" on page 43) is based on these conditions. Larger ambient temperature changes will result in larger drift.

Better drift performance depends on better control of the temperature fluctuations. To realize the highest performance, minimize the frequency and the amplitude of the temperature changes to below 1 °C/hour (1.8 °F/hour). Turbulences around one minute or less can be ignored.

CAUTION

Condensation within the module

Condensation will damage the system electronics.

→ Do not store, ship or use your module under conditions where temperature fluctuations could cause condensation within the module.

→ If your module was shipped in cold weather, leave it in its box and allow it to warm slowly to room temperature to avoid condensation.

NOTE

This module is designed to operate in a typical electromagnetic environment, i.e. where RF transmitters such as mobile telephones may not be used in close proximity.

Physical Specifications

Table 13 Physical Specifications

Type	Specification	Comments
Weight	11 kg 25 lbs	
Dimensions (height × width × depth)	140 × 345 × 435 mm 5.5 × 13.5 × 17 inches	
Line voltage	100 – 240 VAC, ± 10%	Wide-ranging capability
Line frequency	50 or 60 Hz, ± 5%	
Power consumption	220 VA, 85 W / 290 BTU	Maximum
Ambient operating temperature	0–55 °C (32–131 °F)	
Ambient non-operating temperature	-40–70 °C (-4–158 °F)	
Humidity	< 95%, at 25–40 °C (77–104 °F)	Non-condensing
Operating altitude	Up to 2000 m (6500 ft)	
Non-operating altitude	Up to 4600 m (14950 ft)	For storing the instrument
Safety standards: IEC, CSA, UL, EN	Installation Category II, Pollution Degree 2.	For indoor use only.

Performance Specifications

Table 14 Performance Specifications

Type	Specification	Comments
Detection type	Double-beam photometer	
Light source	Deuterium lamp	
Wavelength range	190–600 nm	
Short term noise (ASTM)	<± 0.5 × 10^{-5} AU at 254 nm	See "Specification Conditions" on page 45.
Drift	3 × 10^{-4} AU/hr at 254 nm	See "Specification Conditions" on page 45.
Linearity	> 2 AU (5%) upper limit	See "Specification Conditions" on page 45.
Wavelength accuracy	± 1 nm	Self-calibration with deuterium lines, verification with holmium oxide filter
Band width	6.5 nm typical	
Flow cells	Standard: 14-µL volume, 10-mm cell path length and 40 bar (580 psi) pressure maximum High pressure: 14-µL volume, 10-mm cell path length and 400 bar (5800 psi) pressure maximum Micro: 1-µL volume, 5-mm cell path length and 40 bar (580 psi) pressure maximum Semi-micro: 5-µL volume, 6-mm cell path length and 40 bar (580 psi) pressure maximum	Can be repaired on component level
Control and data evaluation	Agilent ChemStation for LC	

Table 14 Performance Specifications (continued)

Type	Specification	Comments
Analog outputs	Recorder/integrator: 100 mV or 1 V, output range 0.001 – 2 AU, one output	
Communications	Controller-area network (CAN), RS-232C, APG Remote: ready, start, stop and shut-down signals, LAN optional	
Safety and maintenance	Extensive diagnostics, error detection and display (through Agilent ChemStation), leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in major maintenance areas.	
GLP features	Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of lamp burn time with user-settable limits and feedback messages. Electronic records of maintenance and errors. Verification of wavelength accuracy with built-in holmium oxide filter.	
Housing	All materials recyclable.	

Specification Conditions

ASTM: “Standard Practice for Variable Wavelength Photometric Detectors Used in Liquid Chromatography”.

Reference conditions: Standard flow cell, path length 10 mm, flow 1 ml/min LC-grade methanol.

Noise:

Noise:

<± 0.5 × 10-5 AU at 254 nm, TC 2 s, ASTM

RT = 2.2 * TC

Linearity:

Linearity is measured with caffeine at 265 nm.

NOTE The specifications are based on the standard lamp (G1314-60100) and may be not achieved when other lamp types or aged lamps are used.

ASTM drift tests require a temperature change below 2 °C/hour (3.6 F/hour) over one hour period. Our published drift specification is based on these conditions. Larger ambient temperature changes will result in larger drift.

Better drift performance depends on better control of the temperature fluctuations. To realize the highest performance, minimize the frequency and the amplitude of the temperature changes to below 1 °C/hour (1.8 F/hour). Turbulences around one minute or less can be ignored.

Performance tests should be done with a completely warmed up optical unit (> two hours). ASTM measurements require that the detector should be turned on at least 24 hours before start of testing.

Time Constant versus Response Time

According to ASTM E1657-98 „Standard Practice of Testing Variable-Wavelength Photometric Detectors Used in Liquid Chromatography” the time constant is converted to response time by multiplying by the factor 2.2.

3
Installing the Detector

Unpacking the Detector 48
Optimizing the Stack Configuration 50
Installing the Detector 55
Flow Connections to the Detector 58

This chapter provides information on unpacking, checking on completeness, stack considerations and installation of the module.

Unpacking the Detector

Damaged Packaging

If the delivery packaging shows signs of external damage, please call your Agilent Technologies sales and service office immediately. Inform your service representative that the instrument may have been damaged during shipment.

CAUTION

"Defective on arrival" problems

If there are signs of damage, please do not attempt to install the module. Inspection by Agilent is required to evaluate if the instrument is in good condition or damaged.

→ Notify your Agilent sales and service office about the damage.

→ An Agilent service representative will inspect the instrument at your site and initiate appropriate actions.

Condensation

CAUTION

Condensation within the module

Condensation will damage the system electronics.

→ Do not store, ship or use your module under conditions where temperature fluctuations could cause condensation within the module.

→ If your module was shipped in cold weather, leave it in its box and allow it to warm slowly to room temperature to avoid condensation.

Delivery Checklist

Ensure all parts and materials have been delivered with the module. The delivery checklist is shown below. Please report missing or damaged parts to your local Agilent Technologies sales and service office.

Table 15 Variable Wavelength Detector Checklist

Description	Quantity
Variable wavelength detector	1
Power cable	1
Flow cell	As ordered
User Manual	1
Accessory kit (see Table 16)	1

Detector Accessory Kit Contents

Detector Accessory Kit Contents (p/n G1314-68755)

Table 16 Accessory Kit Contents

Description	Part Number	Quantity
CAN cable 0.5 m	5181-1516	1
PEEK outlet capillary kit	5062-8535	1
Fitting male PEEK, 2/pk	0100-1516	1
Tubing assembly 1.2 m	5063-6527	1

Optimizing the Stack Configuration

If your detector is part of a complete AgilentLC system, you can ensure optimum performance by installing the following configurations. These configurations optimizes the system flow path, ensuring minimum delay volume.

One Stack Configuration

One Stack Configuration for Agilent 1260 Infinity LC

Ensure optimum performance by installing the modules of the Agilent 1260 Infinity LC System in the following configuration (See Figure 8 on page 51 and Figure 9 on page 52). This configuration optimizes the flow path for minimum delay volume and minimizes the bench space required.

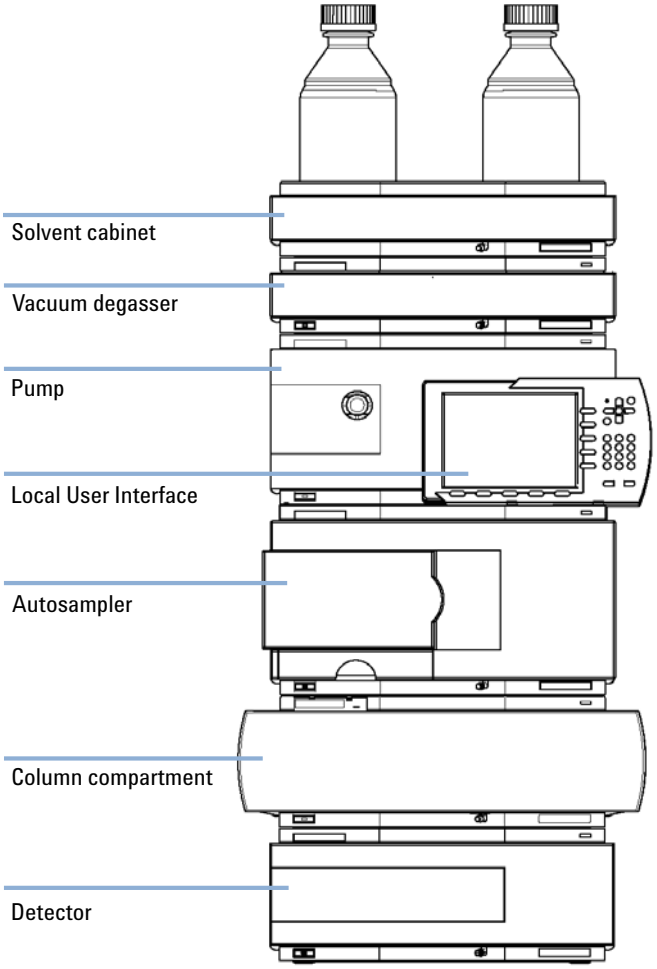


Figure 8 Recommended Stack Configuration for 1260 (Front View)

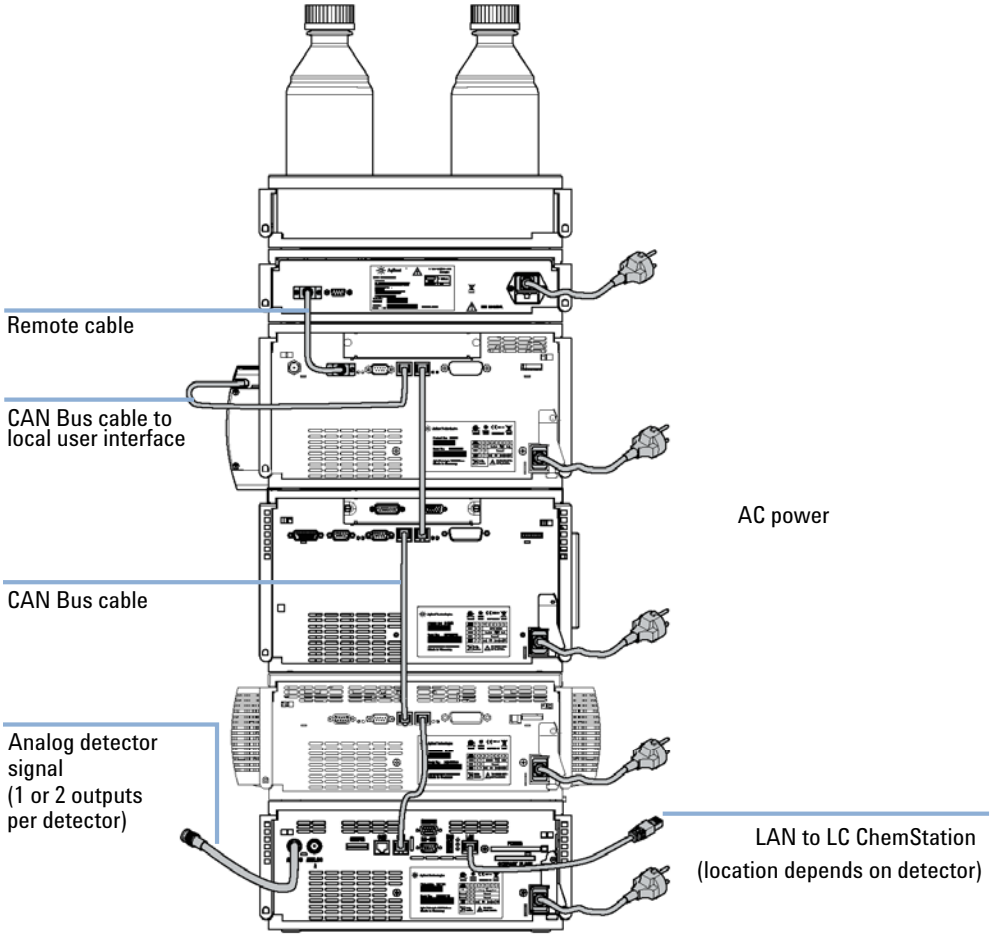


Figure 9 Recommended Stack Configurationfor 1260 (Rear View)

Two Stack Configuration

Two Stack Configuration for Agilent 1260 Infinity LC

To avoid excessive height of the stack when the autosampler thermostat is added to the system it is recommended to form two stacks. Some users prefer the lower height of this arrangement even without the autosampler thermostat. A slightly longer capillary is required between the pump and autosampler. (See Figure 10 on page 53 and Figure 11 on page 54).

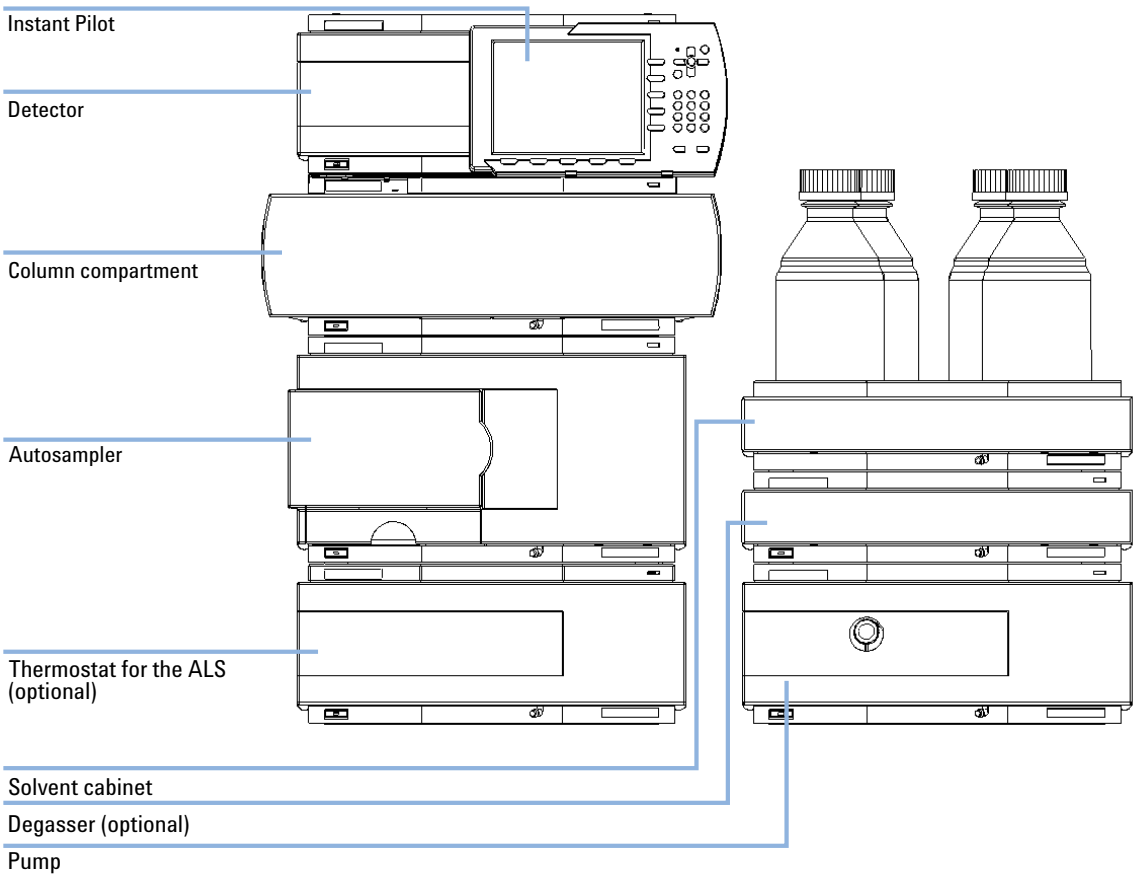


Figure 10 Recommended Two Stack Configuration for 1260 (Front View)

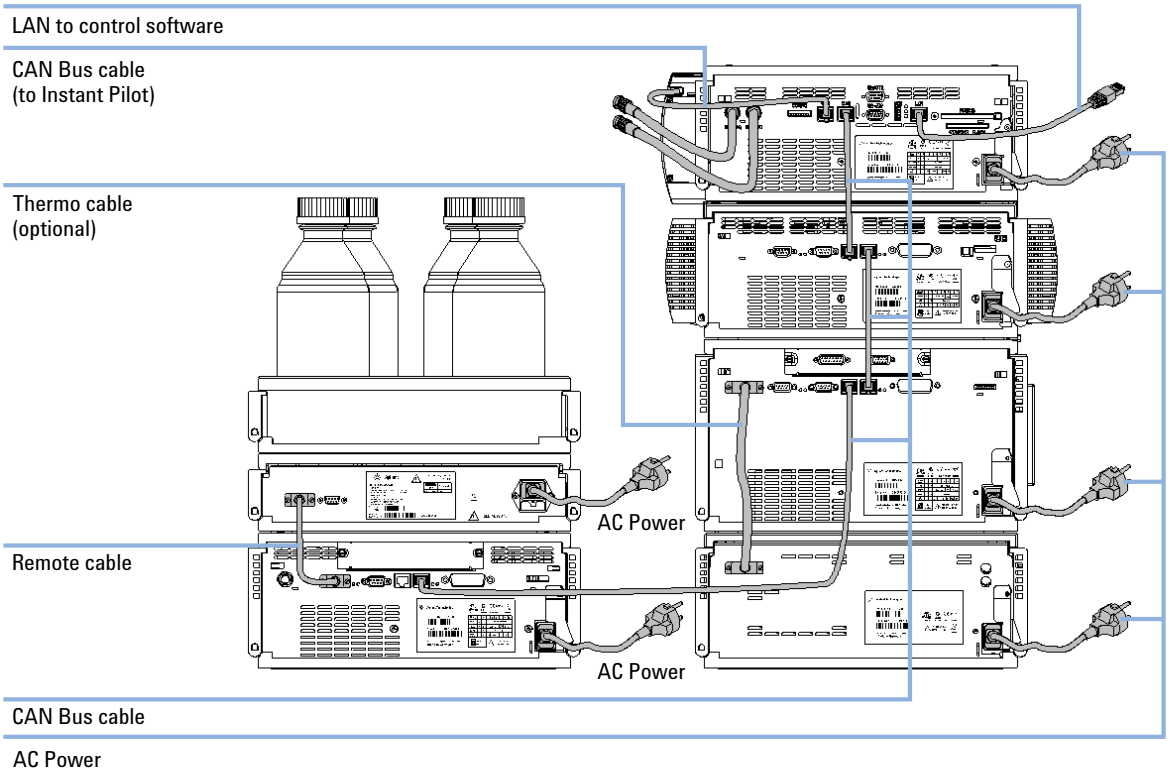


Figure 11 Recommended Two Stack Configuration for 1260 (Rear View)

Installing the Detector

Preparations	Locate bench space. Provide power connections. Unpack the detector.
Parts required	Detector Power cord ChemStation

WARNING

Module is partially energized when switched off, as long as the power cord is plugged in.

Repair work at the module can lead to personal injuries, e.g. shock hazard, when the cover is opened and the module is connected to power.

→ Make sure that it is always possible to access the power plug.

→ Remove the power cable from the instrument before opening the cover.

→ Do not connect the power cable to the Instrument while the covers are removed.

1 Install the LAN interface board in the detector (if required), see “Replacing the Interface Board" on page 156.

2 Place the detector in the stack or on the bench in a horizontal position.

3 Ensure the line power switch at the front of the detector is OFF.

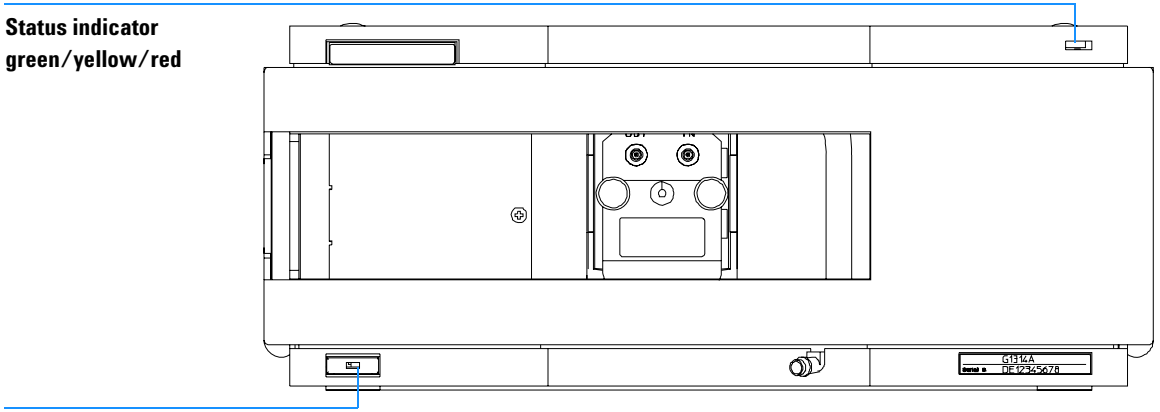


Figure 12 Front View of Detector

NOTE The figure above shows the flow cell already installed. The flow cell area is closed with a metal cover. The flow cell has to be installed as described in "Flow Connections to the Detector" on page 58.

4 Connect the power cable to the power connector at the rear of the detector.

5 Connect the CAN cable to other Agilent 1260 Infinity modules.

6 If a Agilent ChemStation is the controller, connect the LAN connection to the LAN interface board in the detector.

NOTE If an Agilent 1200 Infinity Series DAD/MWD/FLD is in the system, the LAN should be connected to the DAD/MWD/FLD (due to higher data load).

7 Connect the analog cable (optional).

8 Connect the APG remote cable (optional) for non-Agilent 1260 Infinity instruments.

9 Turn ON power by pushing the button at the lower left-hand side of the detector. The status LED should be green.

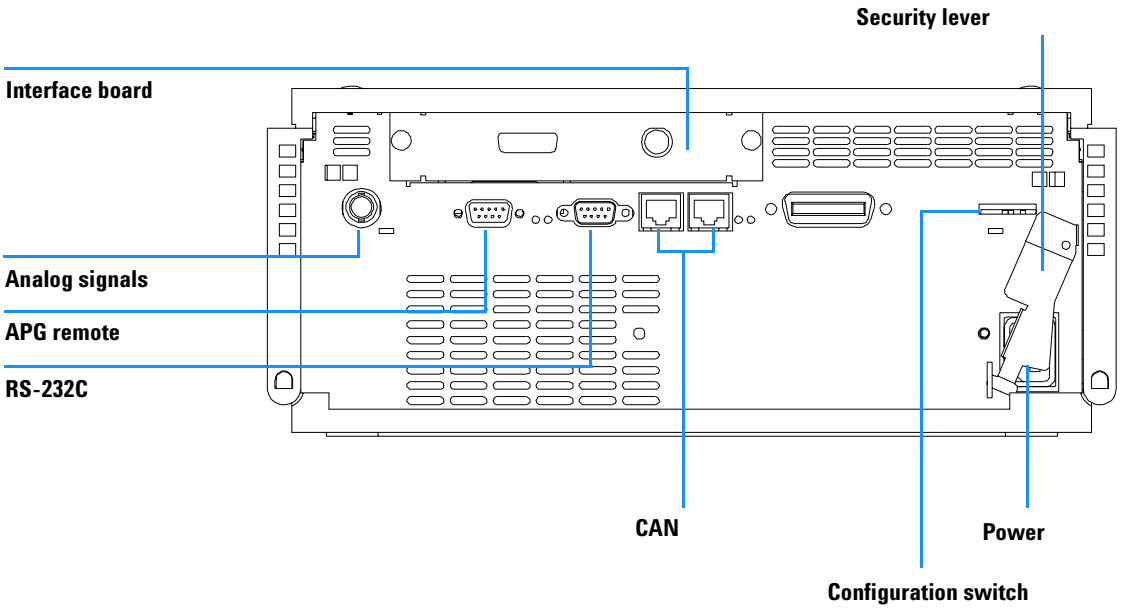


Figure 13 Rear View of Detector

NOTE The detector is turned ON when the line power switch is pressed and the green indicator lamp is illuminated. The detector is turned OFF when the line power switch is protruding and the green light is OFF.

NOTE To disconnect the detector from line, unplug the power cord. The power supply still uses some power, even if the power switch at the front panel is turned OFF

NOTE The detector was shipped with default configuration settings. To change these settings, "Setting the 8-bit Configuration Switch" on page 29.

Flow Connections to the Detector

Preparations	Detector is installed in the LC system.
Parts required	Other modules Parts from accessory kit, see "Accessory Kit Contents" on page 49 Two wrenches 1/4–5/16 inch for capillary connections

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

The handling of solvents, samples and reagents can hold health and safety risks.

→ When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor and follow good laboratory practice.

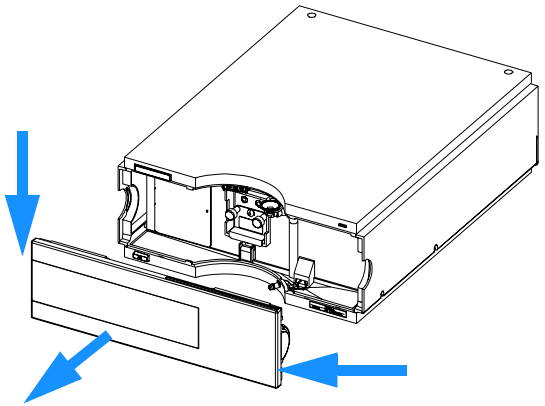
→ The amount of substances should be reduced to the minimal volume required for the analysis.

→ Do not operate the instrument in an explosive atmosphere.

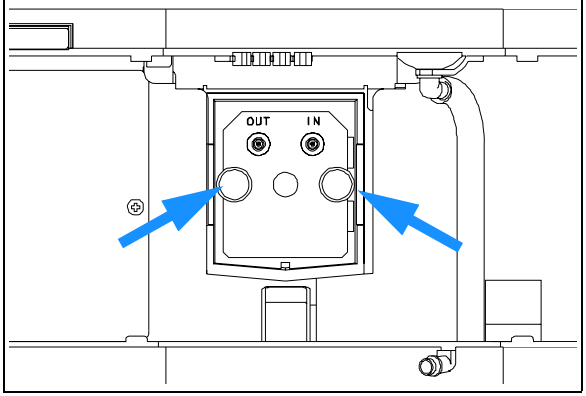
NOTE

The flow cell is shipped with a filling of isopropanol (also recommended when the instrument and/or flow cell is shipped to another location). This is to avoid breakage due to subambient conditions.

1 Press the release buttons and remove the front cover to have access to the flow cell area.

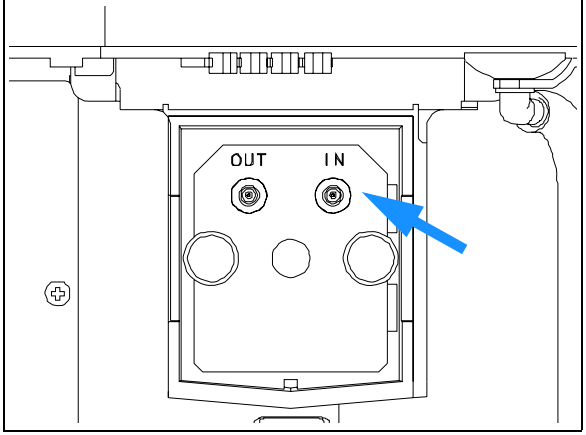


2 Remove the metal cover and install the flow cell. Tighten the cell screws.



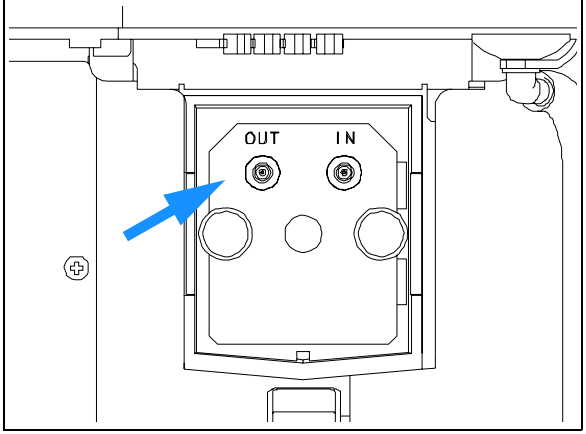
3 Assemble the column-detector capillary.
Depending on the flow cell type it may be a PEEK or SST capillary.

4 Connect the newly assembled fitting of the capillary to the inlet connector.

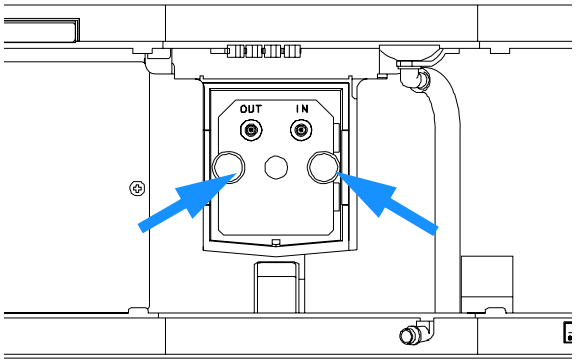


5 Connect the other end of the capillary to the column.

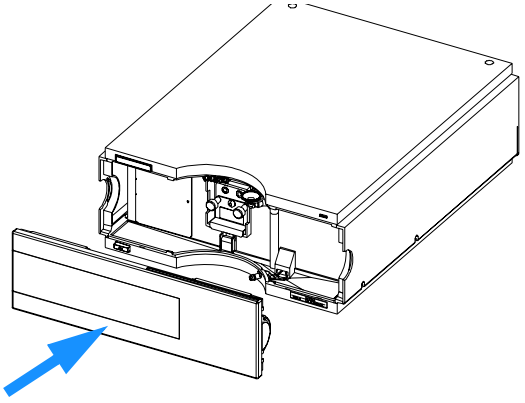
6 Connect the PEEK waste capillary to the outlet connector.



7 Establish a flow and observe for leakage.



8 Replace the front cover.



The installation of the detector is now complete.

NOTE The detector should be operated with the front cover in place to protect the flow cell area against strong drafts from the outside.

4
Using the Detector

Setting up an Analysis 62
Before Using the System 62
Requirements and Conditions 64
Optimization of the System 66
Preparing the HPLC System 67
Running the Sample and Verifying the Results 76
Special Settings of the Detector 77
Control Settings 77
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Scanning with the VWD 79
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This chapter provides information on how to set up the detector for an analysis and explains the basic settings.

Setting up an Analysis

This chapter can be used for

- preparing the system,
- to learn the set up of an HPLC analysis and
- to use it as an instrument check to demonstrate that all modules of the system are correctly installed and connected. It is not a test of the instrument performance.
- Learn about special settings

NOTE All descriptions are based on the Agilent ChemStation B.02.01. Newer versions may look different.

Before Using the System

Solvent Information

Observe recommendations on the use of solvents in chapter “Solvents” in the pump’s reference manual.

Priming and Purging the System

When the solvents have been exchanged or the pumping system has been turned off for a certain time (for example, overnight) oxygen will re-diffuse into the solvent channel between the solvent reservoir, vacuum degasser (when available in the system) and the pump. Solvents containing volatile ingredients will slightly lose these. Therefore priming of the pumping system is required before starting an application.

Table 17 Choice of Priming Solvents for Different Purposes

Activity	Solvent	Comments
After an installation	Isopropanol	Best solvent to flush air out of the system
When switching between reverse phase and normal phase (both times)	Isopropanol	Best solvent to flush air out of the system
After an installation	Ethanol or Methanol	Alternative to Isopropanol (second choice) if no Isopropanol is available
To clean the system when using buffers	Bidistilled water	Best solvent to re-dissolve buffer crystals
After a solvent change	Bidistilled water	Best solvent to re-dissolve buffer crystals
After the installation of normal phase seals (P/N 0905-1420)	Hexane + 5% Isopropanol	Good wetting properties

NOTE The pump should never be used for priming empty tubings (never let the pump run dry). Use a syringe to draw enough solvent for completely filling the tubings to the pump inlet before continuing to prime with the pump.

1 Open the purge valve of your pump (by turning it counterclockwise) and set flow rate to 3-5 ml/min.

2 Flush all tubes with at least 30 ml of solvent.

3 Set flow to required value of your application and close the purge valve.

Pump for approximately 10 minutes before starting your application.

Requirements and Conditions

What You Will Need

Table 18 lists the items you need to have for the set up of the analysis. Some of these are optional (not required for the basic system).

Table 18 What you will need

Agilent 1260 Infinity LC system	Pump (plus degassing)
	Autosampler
	Detector, standard flow cell installed
	Agilent ChemStationor Instant Pilot G4208A (optional for basic operation)
	System should be correctly set up for LAN communication with the Agilent ChemStation
Column:	Zorbax Eclipse XDB-C18, 4.6 x 150 mm, 5 um Part No. 993967-902 or Part No. 5063-6600
Standard:	Part No. 01080-68704 0.15 wt.% dimethylphthalate, 0.15 wt.% diethylphthalate, 0.01 wt.% biphenyl, 0.03 wt.% o-terphenyl in methanol

Conditions

A single injection of the isocratic test standard is made under the conditions given in Table 19:

Table 19 Conditions

Flow	1.5 ml/minute
Stoptime	8 minutes
Solvent	100% (30% water/70% Acetonitrile)
Temperature	Ambient
Wavelength	254 nm
Injection Volume	1 µL

Typical Chromatogram

A typical chromatogram for this analysis is shown in Figure 14. The exact profile of the chromatogram will depend on the chromatographic conditions. Variations in solvent quality, column packing, standard concentration and column temperature will all have a potential effect on peak retention and response.

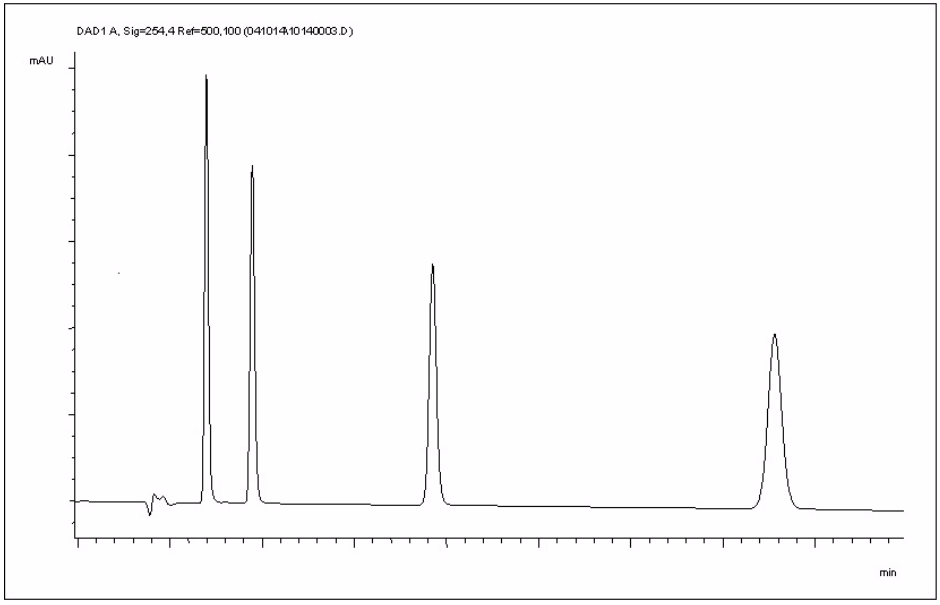


Figure 14 Typical Chromatogram with UV-detector

Optimization of the System

The settings used for this analysis are specific for this purpose. For other applications the system can be optimized in various ways. Please refer to the section “Optimizing the Detector" on page 85.

Preparing the HPLC System

1 Turn on the Agilent ChemStation PC and the monitor.

2 Turn on the Agilent 1260 Infinity HPLC modules.

3 Start the Agilent ChemStation. If the pump, autosampler, thermostatted column compartment and detector are found, the ChemStation screen should look like shown in Figure 15.

The System status is red (Not Ready).

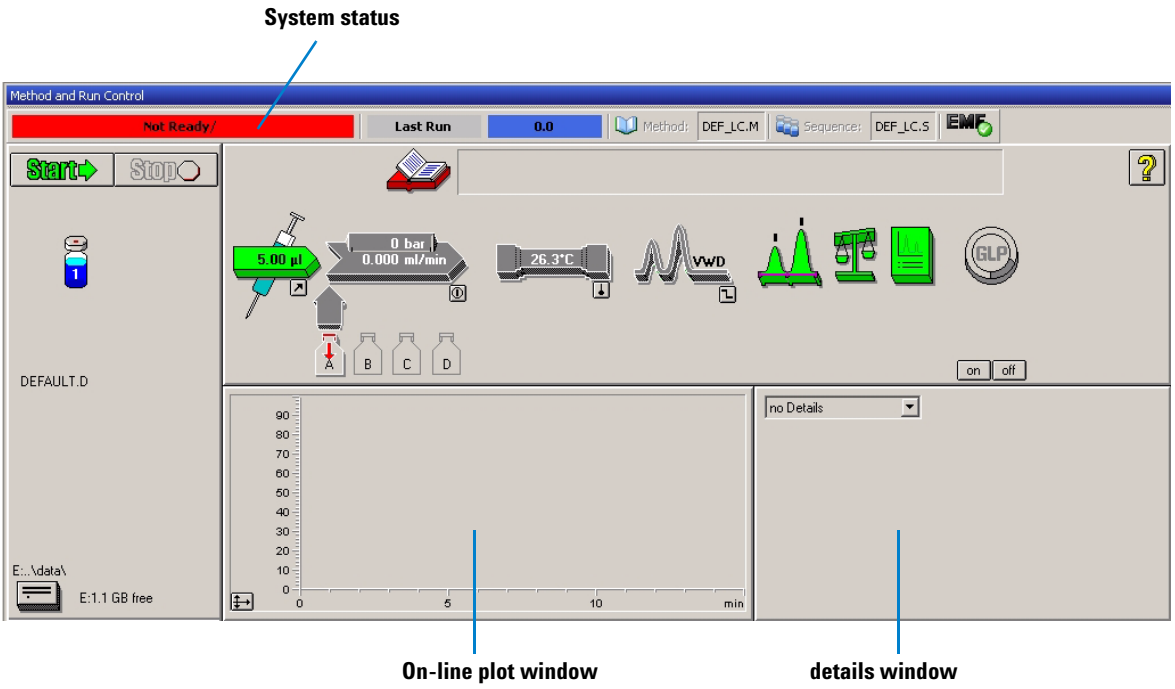


Figure 15 Initial ChemStation screen (Method and Run Control)

4 Turn on the detector lamp, pump and autosampler by clicking the *System On* button or the buttons below the module icons on the graphical user interface (GUI). After some time, the pump, thermostatted column compartment and detector module will turn to green.

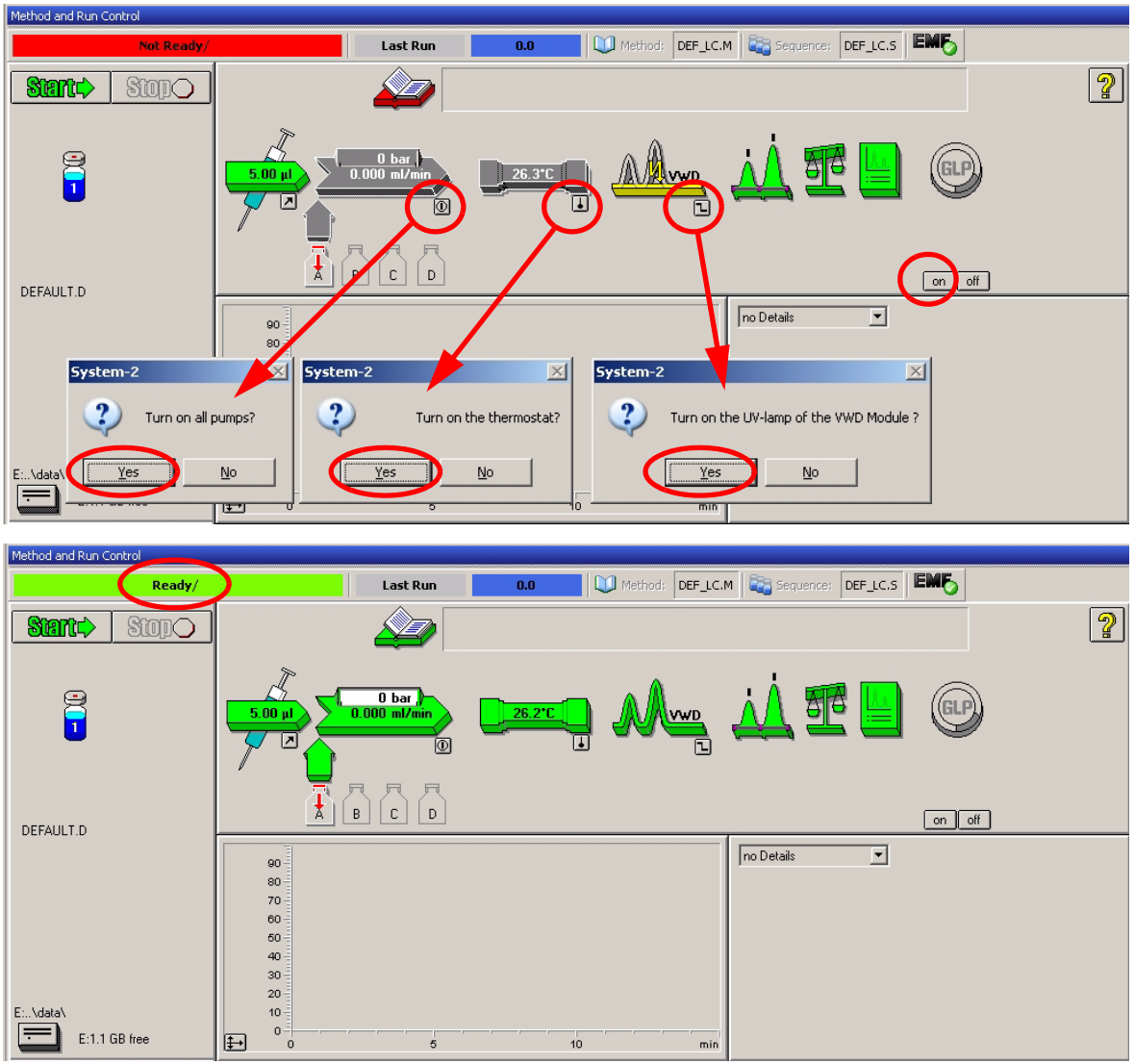


Figure 16 Turning on the HPLC Module

5 Purge the pump. For more information see “Priming and Purging the System" on page 62.

6 Allow the detector to warm up of at least 60 minutes to provide a stable baseline (see example in Figure 17).

NOTE For reproducible chromatography, the detector and lamp should be on for at least one hour. Otherwise the detector baseline may still drift (depending on the environment).

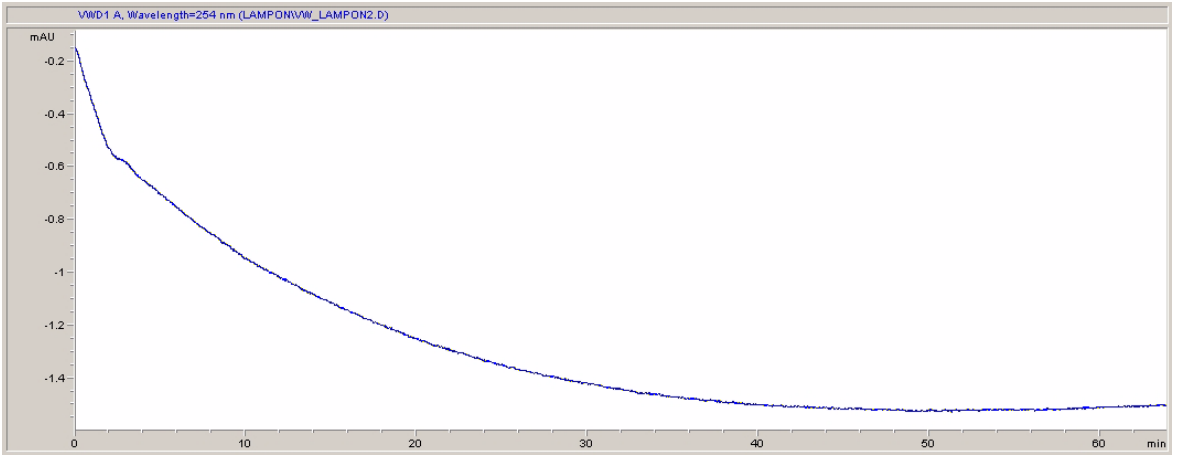


Figure 17 Stabilization of Baseline

7 For the isocratic pump, fill the solvent bottle with the mixture of HPLC-grade bi-distilled water (30 %) and acetonitrile (70 %). For binary- and quaternary pumps you can use separate bottles.

8 Click on the *Load Method* button and select DEF_LC.M and press *OK*. Alternative double-click on the method in the method window. The default LC method parameters are transferred into the modules.

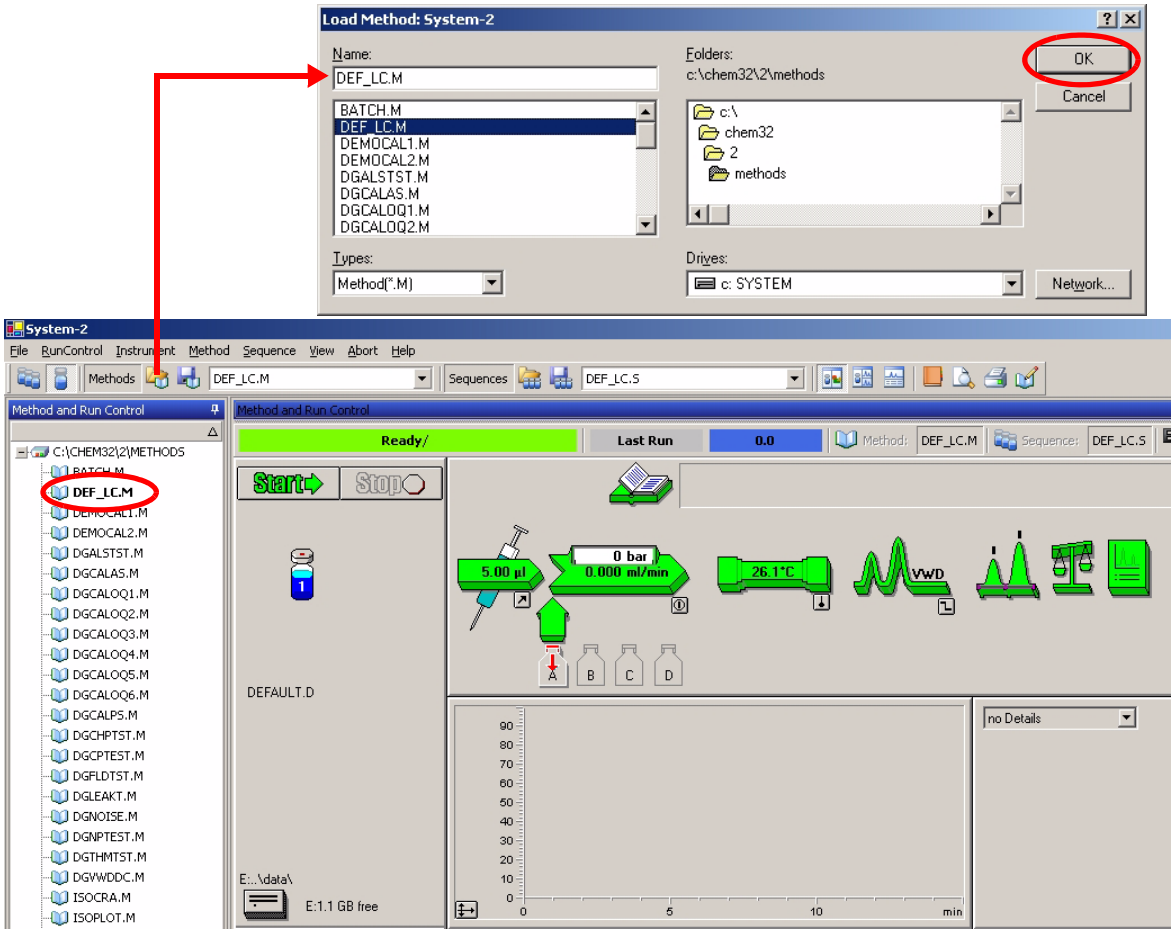


Figure 18 Loading Default LC Method

9 Click on the module icons (Figure 19) and open the *Setup* of these modules. Figure 20 on page 72 shows the detector settings (do not change the detector parameters at this time).

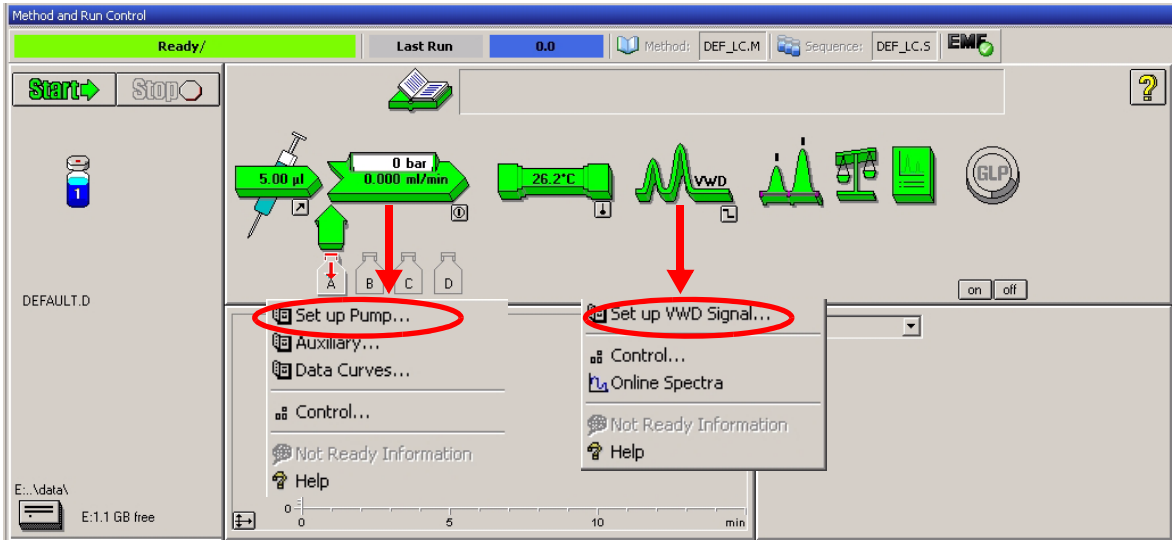
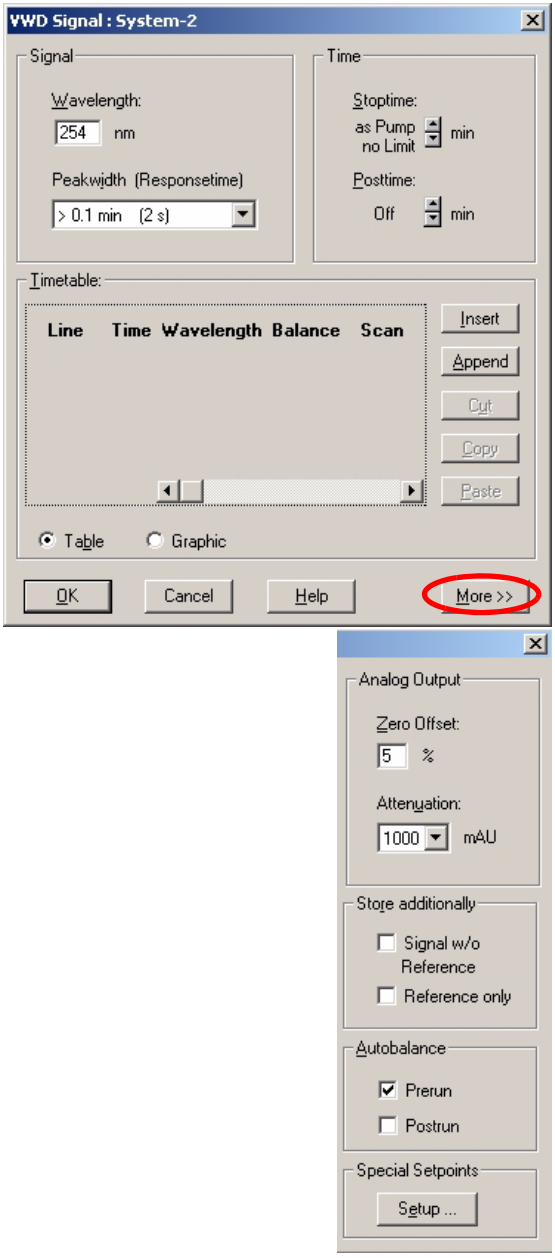


Figure 19 Open the module menu

10 Enter the pump parameters mentioned under "Conditions" on page 65.



- 1 signal with individual wavelength setting
- stop and post time can be set (if required)
- peakwidth depends on the peaks in the chromatogram, see page 83.
- time table for programmable actions during the run

- Zero Offset Limits: 1 to 99% in steps of 1%
- Attenuation Limits: 0.98 to 4000 mAU at discrete values for either 100 mV or 1 V full scale

- additional signals can be stored with the normal signal (for diagnostics)

- autobalance to zero absorbance (on the analog output plus offset) at begin and/or end of run

- see "Special Setpoints" on page 82

Figure 20 Detector Settings (default)

11 Pump the water/acetonitrile (30/70 %) mobile phase through the column for 10 minutes for equilibration.

12 Click the button and select *Change...* to open the Signal Plot information. Select the *Pump: Pressure* and the *VWD A: Signal 254* as signals. Change the Y-range for the VWD to 1 mAU and the offset to 20% and the pressure offset to 50%. The X-axis range should be 15 minutes. Press *OK* to exit this screen.

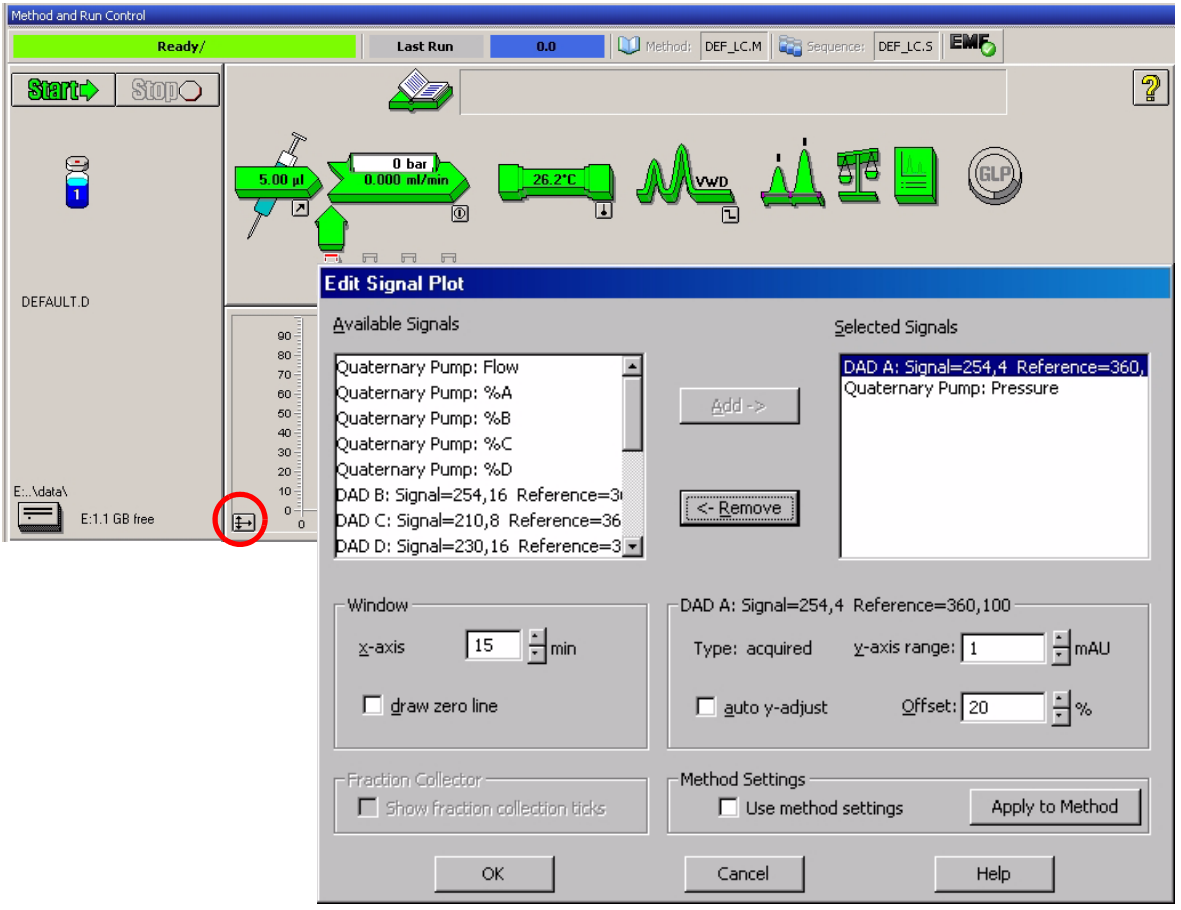


Figure 21 Edit Signal Plot Window

The Online Plot (Figure 22 on page 74) shows both, the pump pressure and the detector absorbance signals. Pressing *Adjust* the signals can be reset to the offset value and *Balance* would do a balance on the detector.

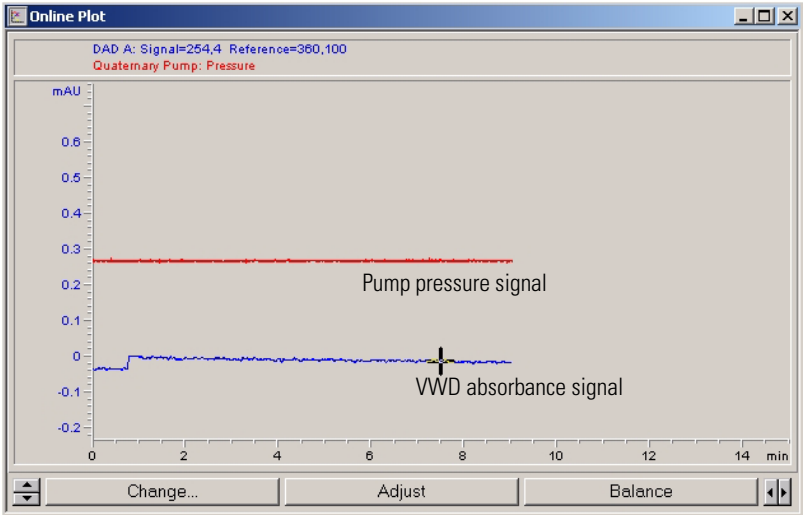


Figure 22 Online Plot Window

13 If both baselines are stable, set the Y-range for the detector signal to 100 mAU.

NOTE If you start with a new UV-lamp for the first time, the lamp may show initial drift for some time (burn-in effect).

14 Select the menu item *RunControl -> Sample Info* and enter information about this application (Figure 23 on page 75). Press *OK* to leave this screen.

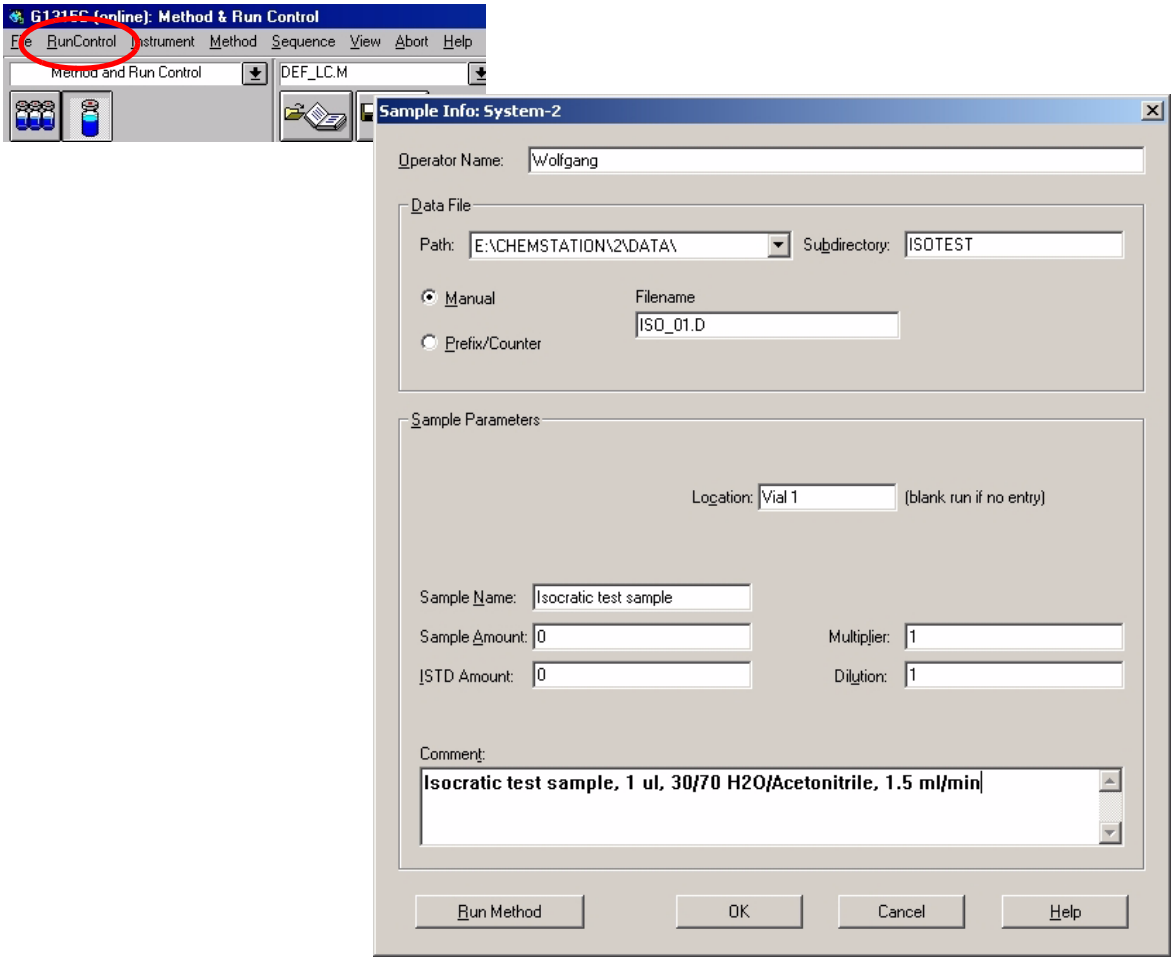


Figure 23 Sample Information

15 Fill the content of an isocratic standard sample ampoule into a vial and seal the vial with a cap and place the vial into autosampler tray (position #1).

Running the Sample and Verifying the Results

1 To start a run select the menu item *RunControl -> Run Method*.

2 This will start the modules and the online plot on the Agilent ChemStation will show the resulting chromatogram.

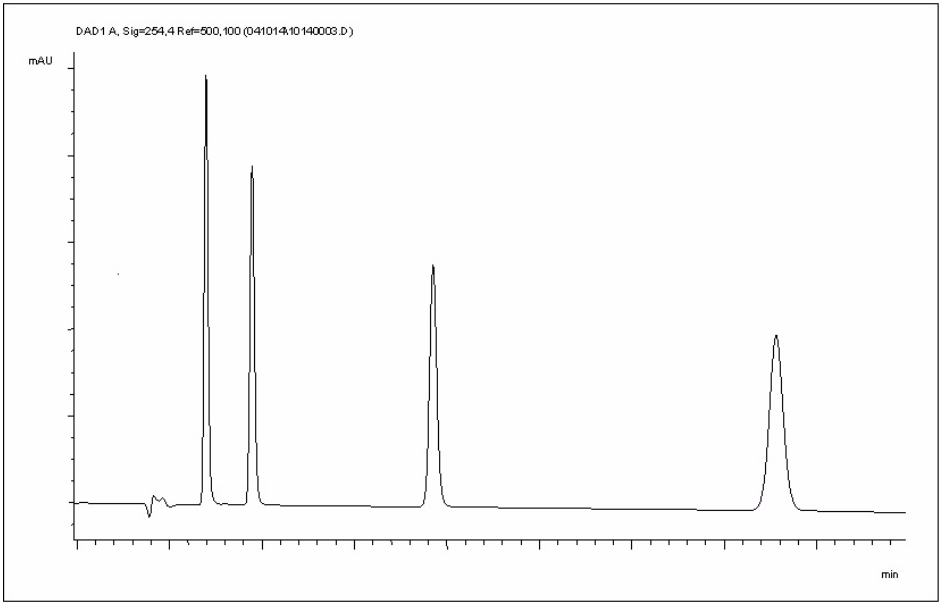
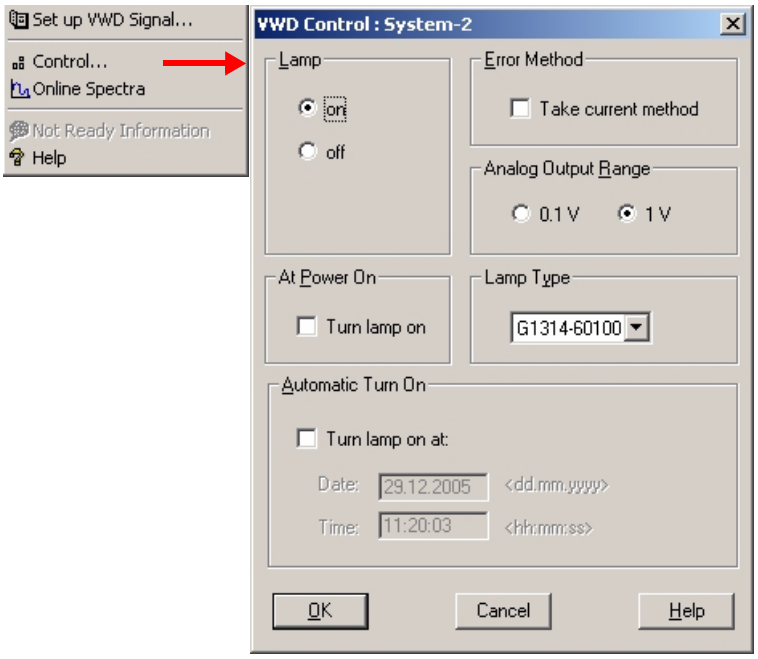


Figure 24 Chromatogram with Isocratic Test Sample

NOTE Information about using the Data Analysis functions can be obtained from the *Using your ChemStation* manual supplied with your system.

Special Settings of the Detector

Control Settings



- **Lamp:** turn on and off of UV-lamp.
- **At Power On:** automatic lamp-on at power on.
- **Error Method:** take error method or current method (in case of an error).
- **Analog Output Range:** can be set to either 100 mV or 1 V full scale, see also "Analog Output Settings" on page 81.
- **Lamp Type:** can be set to either G1314-60100 (standard VWD lamp) or 2140-0590 (DAD lamps), see also "Exchanging a Lamp" on page 142.
- **Automatic Turn On:** lamps can be programmed (detector must be on for this).
- **Help:** online help.

Figure 25 Detector control settings

Online Spectra

1 To view the online spectra select *Online Spectra*.

NOTE This online spectrum is taken during a stop-flow condition only while the peak is kept in the flow cell, see "Scanning with the VWD" on page 79.

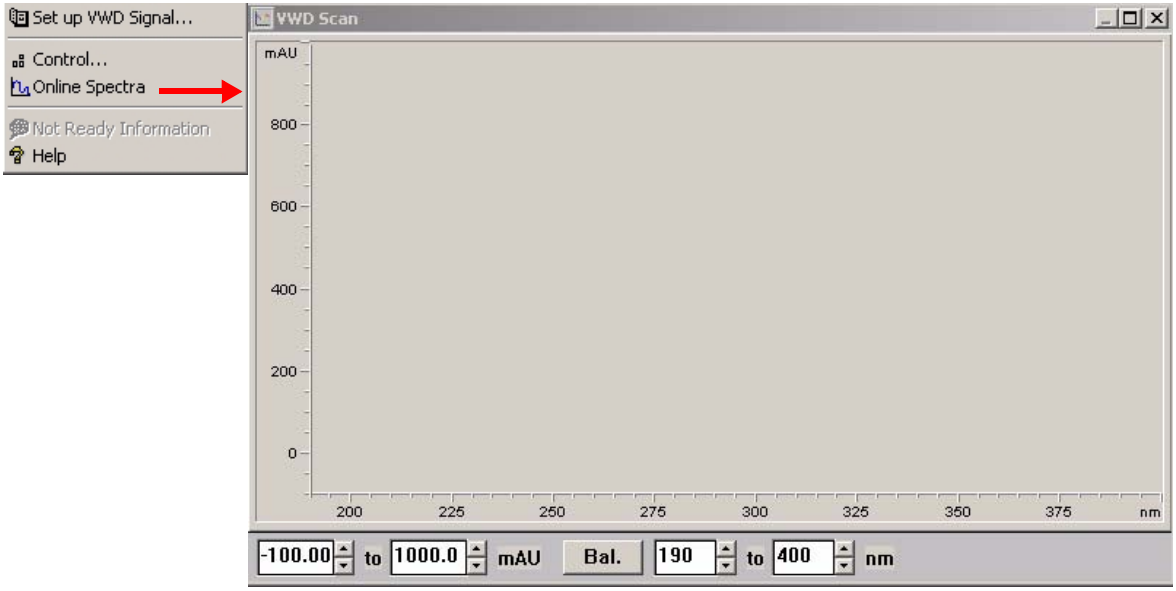


Figure 26 Online Spectra Window

2 Change the absorbance and wavelength range according your needs.

Scanning with the VWD

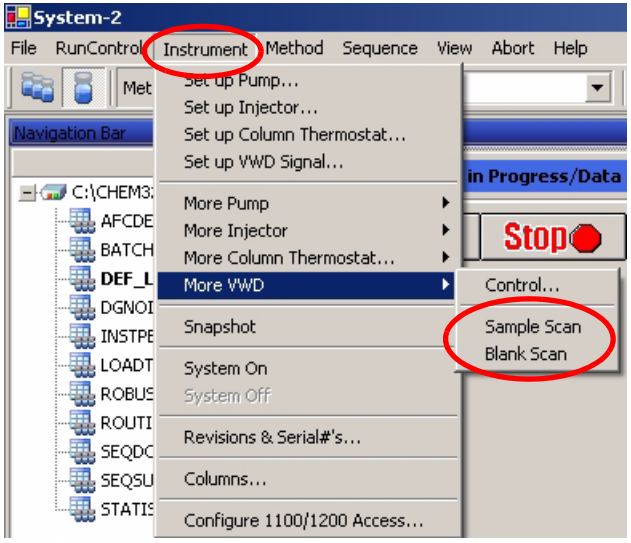
NOTE Access to the scan feature is only possible during run.

1 Set up a run.

2 Start a run.

3 While running on the baseline, select from the menu *Instrument - More VWD - Blank Scan*, see Figure 27 on page 79.

A background scan is stored in the memory.



- **Step 1: Blank Scan:** scan of the background (solvent) is stored in the memory.
- **Step 2: Sample Scan:** scan of the peak of interest is taken while the peak stays in the flow cell (stop-flow condition).
- **Online Spectrum:** Sample Scan minus Blank Scan.

Figure 27 Taking Online Spectra

4 When the peak of interest enters the flow cell, stop the flow (set flow rate to zero or open the purge valve) and wait a few moments to stabilize the concentration.

NOTE Turning off the pump would stop the run and no access to the sample scan is possible.

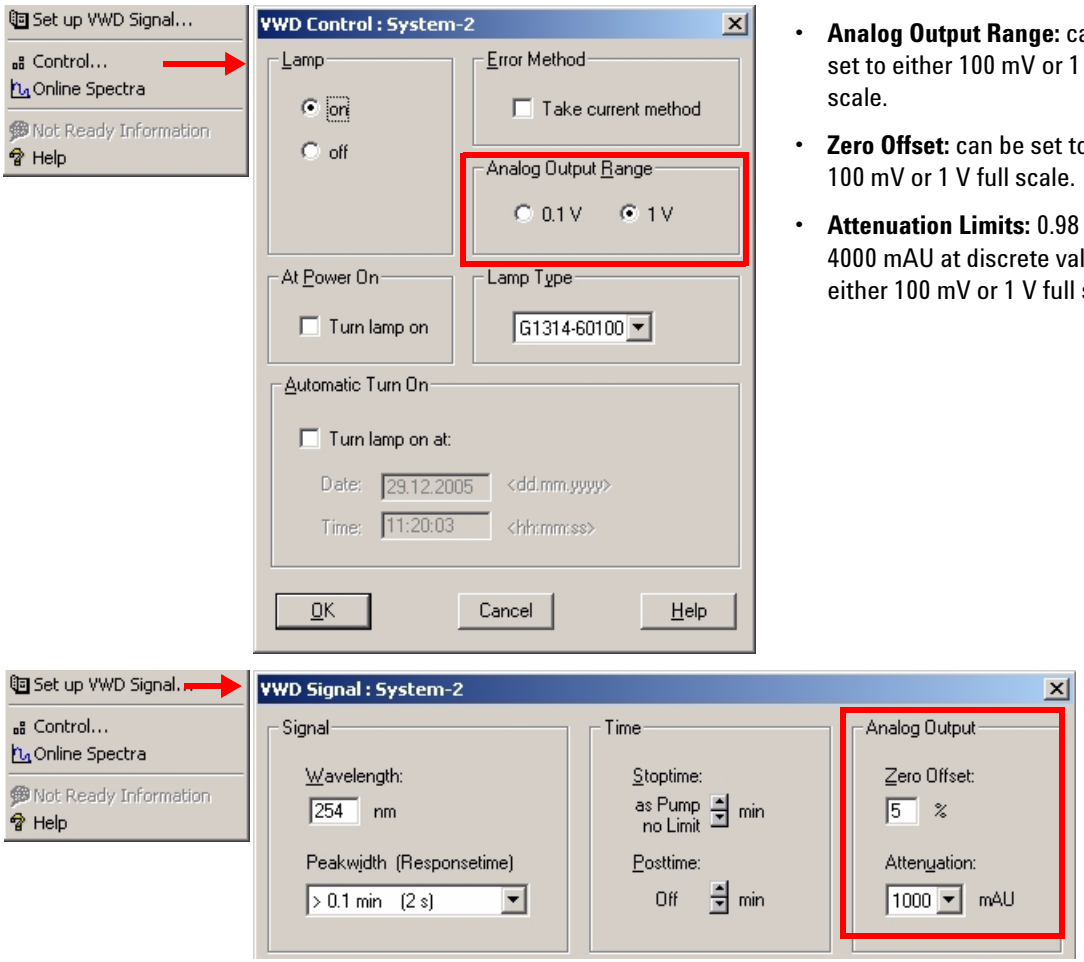
5 Select from the menu
Instrument - More VWD - Sample Scan.

A sample scan is taken in the range defined under “Special Setpoints" on page 82 and the Online Spectra window (see “Online Spectra" on page 78) displays the result (Sample Scan minus Blank Scan).

Analog Output Settings

1 To change the Output Range of the analog outputs select *VWD Control*.

2 To change the offset and the attenuation select *VWD Signal - More*.



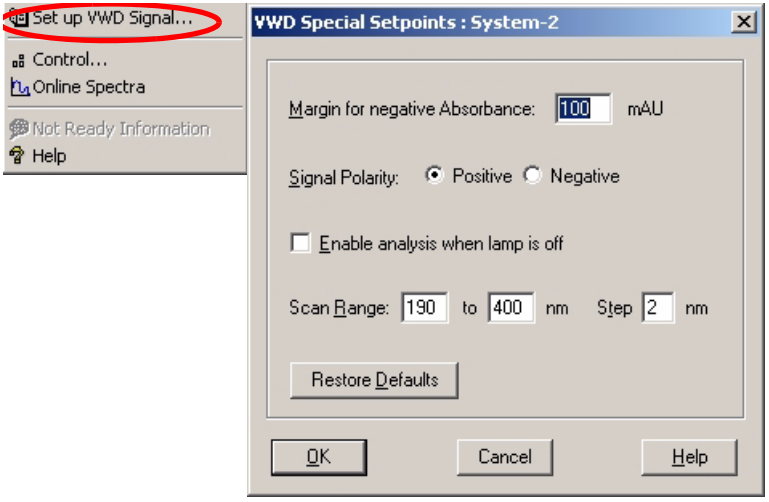
- **Analog Output Range:** can be set to either 100 mV or 1 V full scale.
- **Zero Offset:** can be set to either 100 mV or 1 V full scale.
- **Attenuation Limits:** 0.98 to 4000 mAU at discrete values for either 100 mV or 1 V full scale.

Figure 28 Analog Output Settings

3 Change the values if required.

Special Setpoints

1 To change the offset and the attenuation select *VWD Signal - More - Special Setpoints*.



Margin for negative Absorbance: Use this field to modify the detector's signal handling to increase the margin for negative absorbance. Use this option if, for example, your solvent gradient produces a decreasing baseline absorbance, and for GPC analyses.

Limits: 100 to 4000 mAU.

Signal Polarity: can be switched to negative (if required).

Enable analysis when lamp is off: if the VWD is not used in a dual detector setup (lamp off), the not-ready condition is not stopping the analysis.

Scan Range / Step: Used for stop-flow scanning, see "Scanning with the VWD" on page 79.

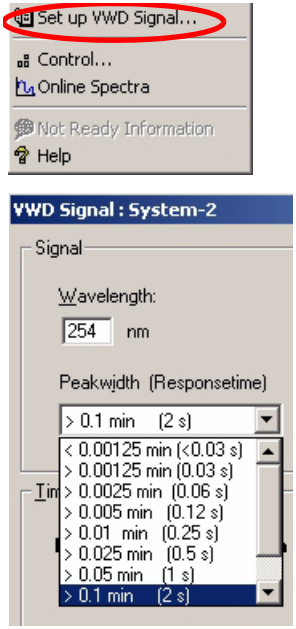
Figure 29 Spectra Window

NOTE **Margin for negative Absorbance**: The higher the value the greater the baseline noise. Set this value only if you expect negative absorbance greater than -100 mAU.

Peakwidth Settings

NOTE Do not use peak width shorter than necessary, see also "Set the Detector Parameters" on page 91.

1 To change the Peakwidth settings select *Setup Detector Signals*.
2 In the section Peakwidth (Responsetime) click on the drop-down list.
3 Change the Peakwidth according to your needs.



Peakwidth enables you to select the peak width (response time) for your analysis. The peak width is defined as the width of a peak, in minutes, at half the peak height. Set the peak width to the narrowest expected peak in your chromatogram. The peak width sets the optimum response time for your detector. The peak detector ignores any peaks that are considerably narrower, or wider, than the peak width setting. The response time is the time between 10% and 90% of the output signal in response to an input step function. When the All spectrum storage option is selected, then spectra are acquired continuously depending on the setting of the peak width. The time specified by the peak width is used as a factor in the acquisition of spectra. The acquisition time for one spectrum is slightly less than the peak width divided by 8, see Table 20 on page 84.

Limits: When you set the peak width (in minutes), the corresponding response time is set automatically and the appropriate data rate for signal acquisition is selected as shown in Table 20 on page 84.

Figure 30 Peakwidth Setting

Table 20 Peak Width — Response Time — Data Rate (G1314B)

Peak Width (min) *	Response Time (sec)	Data Rate (Hz)
<0.005	0.12	13.74
>0.005	0.12	13.74
>0.01	0.25	13.74
>0.025	0.5	13.74
>0.05	1.0	6.87
>0.10	2.0	3.43
>0.20	4.0	1.72
>0.40	8.0	0.86

* Values in the User Interface may be rounded.

Table 21 Peak Width — Response Time — Data Rate (G1314C)

Peak Width (min) *	Response Time (sec)	Data Rate (Hz)
<0.00125	<0.031	55
>0.00125	0.031	27.5
>0.0025	0.062	13.74
>0.005	0.12	13.74
>0.01	0.25	13.74
>0.025	0.5	13.74
>0.05	1.0	6.87
>0.10	2.0	3.43
>0.20	4.0	1.72
>0.40	8.0	0.86

* Values in the User Interface may be rounded.

Optimizing the Detector

Additional theoretical information can be found in chapter “How to optimize the detector" on page 87.

5
How to optimize the detector

Optimizing the Detector Performance 88

This chapter gives hints on how to select the detector parameters and the flow cell.

Optimizing the Detector Performance

The detector has a variety of parameters that can be used to optimize performance.

The information below will guide you on how to get the best detector performance. Follow these rules as a start for new applications. It gives a rule-of-thumb for optimizing the detector parameters.

Match the Flow Cell to the Column

Figure 31 recommends the flow cell that matches the column used. If more than one selection is appropriate, use the larger flow cell to get the best detection limit. Use the smaller flow cell for best peak resolution.

Column length	Typical peak width	Recommended flow cell			
<= 5 cm	0.025 min	Micro flow cell			
10 cm	0.05 min		Semi-micro flow cell		
20 cm	0.1 min			Standard flow cell	
>= 40 cm	0.2 min				
	Typical flow rate	0.05 – 0.2 ml/min	0.2 – 0.4 ml/min	0.4 – 0.8 ml/min	1 – 2 ml/min
Internal column diameter		1.0 mm	2.1 mm	3.0 mm	4.6 mm

Figure 31 Choosing a Flow Cell

Flow Cell Path Length

Lambert-Beer's law shows a linear relationship between the flow cell path length and absorbance.

$$Absorbance = -\log T = \log\frac{I_0}{I} = \varepsilon \cdot C \cdot d$$

where

T	is the transmission, defined as the quotient of the intensity of the transmitted light I divided by the intensity of the incident light, I_0,
ε	is the extinction coefficient, which is a characteristic of a given substance under a precisely-defined set of conditions of wavelength, solvent, temperature and other parameters,
C [mol/L]	is the concentration of the absorbing species, and
d [cm]	is the path length of the cell used for the measurement.

Therefore, flow cells with longer path lengths yield higher signals. Although noise usually increases little with increasing path length, there is a gain in signal-to-noise ratio. For example, in Figure 32 on page 90 the noise increased by less than 10 % but a 70 % increase in signal intensity was achieved by increasing the path length from 6 mm to 10 mm.

When increasing the path length, the cell volume usually increases – in our example from 5 – 13 µL. Typically, this causes more peak dispersion. As Figure 32 on page 90 demonstrates, this did not affect the resolution in the gradient separation in our example.

As a rule-of-thumb the flow cell volume should be about 1/3 of the peak volume at half height. To determine the volume of your peaks, take the peak width as reported in the integration results multiply it by the flow rate and divide it by 3).

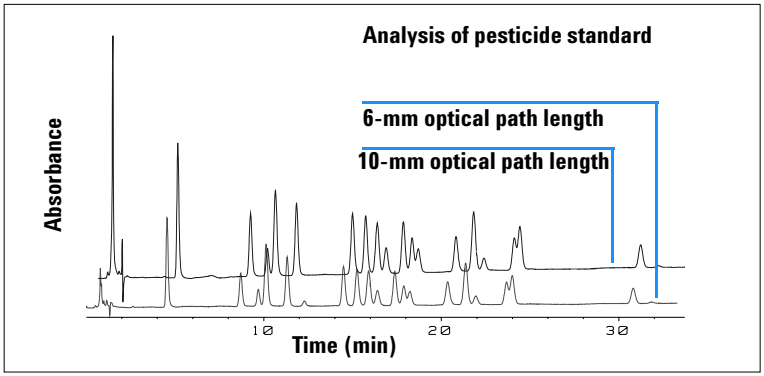


Figure 32 Influence of Cell Path Length on Signal Height

Traditionally LC analysis with UV detectors is based on comparing measurements with internal or external standards. To check photometric accuracy of the Agilent 1260 Infinity VWD it is necessary to have more precise information on path lengths of the VWD flow cells.

The correct response is:

```
expected response * correction factor
```

Please find below the details of the Agilent 1260 Infinity VWD flow cells:

Table 22 Correction factors for Agilent 1260 Infinity VWD flow cells

Flow cell type	Cell volume	Part number	Path length (nominal)	Path length (actual)	Correction factor
Standard flow cell	14 µL	G1314-60086	10 mm	10.15 ± 0.19 mm	10/10.15
Semi-micro flow cell	5 µL	G1314-60083	6 mm	6.10 ± 0.19 mm	6/6.10
Micro flow cell	1 µL	G1314-60081	5 mm	4.80 ± 0.19 mm	5/4.8
High Pressure flow cell	14 µL	G1314-60082	10 mm	10.00 ± 0.19 mm	6/5.75

NOTE However you have to be aware that there are additional tolerance of gasket thickness and its compression ratio which is supposed to be very small in comparison with the machining tolerance.

Set the Detector Parameters

1 Set peakwidth as close as possible to the width (at half height) of a narrow peak of interest.

Table 23 Peakwidth Settings

Peakwidth at half height *	Rise time [10.. 90%]	Data rate	Module
< 0.00125 minutes	< 0.031 seconds	54.96 Hz	G1314C
0.00125 minutes	0.031 seconds	27.48 Hz	G1314C
0.0025 minutes	0.062 seconds	13.74 Hz	G1314C
0.005 minutes	0.125 seconds	13.74 Hz	G1314B / G1314C
0.01 minutes	0.25 seconds	13.74 Hz	G1314B / G1314C
0.025 minutes	0.50 seconds	13.74 Hz	G1314B / G1314C
0.05 minutes	1 second	6.87 Hz	G1314B / G1314C
0.1 minutes	2 seconds	3.43 Hz	G1314B / G1314C
0.2 minutes	4 seconds	1.72 Hz	G1314B / G1314C
0.4 minutes	8 seconds	0.86 Hz	G1314B / G1314C

* Values in the User Interface may be rounded.

2 Choose the sample wavelength.
- at a longer wavelength than the cut-off wavelength of the mobile phase,
- at a wavelength where the analytes have strong absorptivity if you want to get the lowest possible detection limit,
- at a wavelength with moderate absorptivity if you work with high concentrations, and
- preferably where the spectrum is flat for better linearity.

3 Consider to use time-programming to further optimization.

6
Troubleshooting and Diagnostics

Overview of the Detector's Indicators and Test Functions 94
Status Indicators 95
Available Tests vs User Interfaces 97
Agilent LabAdvisor Software 98

Overview about the troubleshooting and diagnostic features.

Overview of the Detector's Indicators and Test Functions

Status Indicators

The detector is provided with two status indicators which indicate the operational state (prerun, run, and error states) of the detector. The status indicators provide a quick visual check of the operation of the detector .

Error Messages

In the event of an electronic, mechanical or hydraulic failure, the detector generates an error message in the user interface. For each message, a short description of the failure, a list of probable causes of the problem, and a list of suggested actions to fix the problem are provided .

Test Functions

A series of test functions are available for troubleshooting and operational verification after exchanging internal components.

Wavelength Verification / Recalibration

Wavelength recalibration is recommended after repair of internal components, and on a regular basis to ensure correct operation of the detector. The detector uses the deuterium alpha and beta emission lines for wavelength calibration.

Diagnostic Signals

The detector has several signals (internal temperatures, voltages and currents of lamps) that can be used for diagnosing baseline problems.

Status Indicators

Two status indicators are located on the front of the detector. The lower left indicates the power supply status, the upper right indicates the detector status.

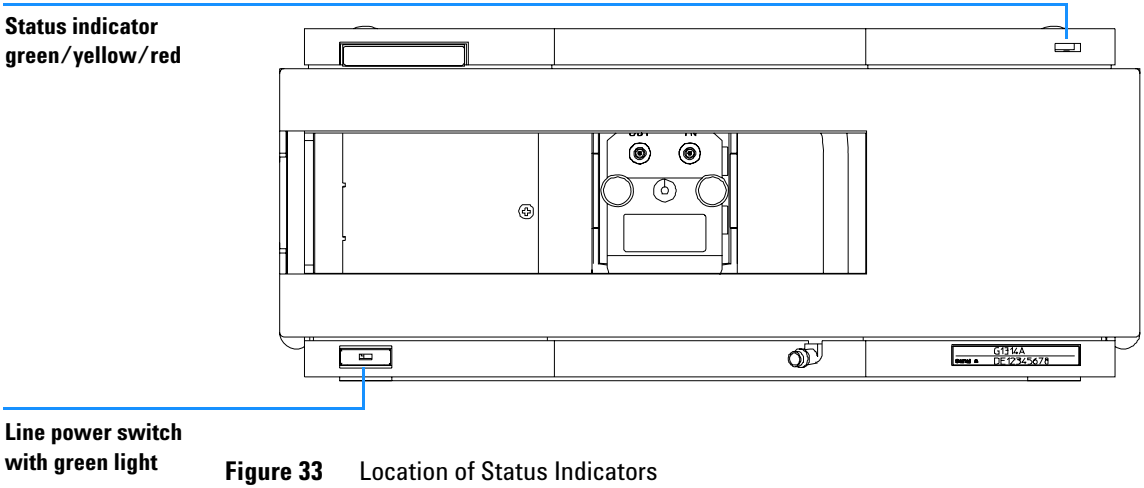


Figure 33 Location of Status Indicators

Power Supply Indicator

The power supply indicator is integrated into the main power switch. When the indicator is illuminated (*green*) the power is ON.

Module Status Indicator

The detector status indicator indicates one of four possible detector conditions:

- When the status indicator is OFF (and power switch light is on), the detector is in a *prerun* condition, and is ready to begin an analysis.
- A *green* status indicator, indicates the detector is performing an analysis (*run* mode).
- A *yellow* indicator indicates a *not-ready* condition. The detector is in a not-ready state when it is waiting for a specific condition to be reached or completed (for example, immediately after changing a set point), or while a self-test procedure is running.
- An *error* condition is indicated when the status indicator is *red*. An error condition indicates the detector has detected an internal problem which affects correct operation of the detector. Usually, an error condition requires attention (e.g. leak, defective internal components). An error condition always interrupts the analysis.
- A red-blinking (modules with on-board LAN) or yellow-blinking (modules without on-board LAN) indicates that the module is in resident mode (e.g. during update of main firmware).
- A fast red-blinking (modules with on-board LAN) or fast yellow-blinking (modules without on-board LAN) indicator indicates that the module is in boot loader mode (e.g. during update of main firmware). In such a case try to re-boot the module or try a cold-start.

Available Tests vs User Interfaces

- Depending on the user interface, the available tests and the screens/reports may vary (see Chapter "Test Functions and Calibrations").
- Preferred tool should be the Agilent Diagnostic Software, see “Agilent Lab Advisor Software” on page 156.
- Screenshots used within these procedures are based on the Agilent Lab Advisor Software.

Agilent LabAdvisor Software

The Agilent Lab Advisor software is a standalone product that can be used with or without data system. Agilent Lab Advisor software helps to manage the lab for high quality chromatographic results and can monitor in real time a single Agilent LC or all the Agilent GCs and LCs configured on the lab intranet.

Agilent Lab Advisor software provides diagnostic capabilities for all Agilent 1200 Infinity Series modules. This includes diagnostic capabilities, calibration procedures and maintenance routines for all the maintenance routines.

The Agilent Lab Advisor software also allows users to monitor the status of their LC instruments. The Early Maintenance Feedback (EMF) feature helps to carry out preventive maintenance. In addition, users can generate a status report for each individual LC instrument. The tests and diagnostic features as provided by the Agilent Lab Advisor software may differ from the descriptions in this manual. For details refer to the Agilent Lab Advisor software help files.

This manual provides lists with the names of Error Messages, Not Ready messages, and other common issues.

7
Error Information

What Are Error Messages 100
General Error Messages 101
Detector Error Messages 107

This chapter describes the meaning of detector error messages, and provides information on probable causes and suggested actions how to recover from error conditions.

What Are Error Messages

Error messages are displayed in the user interface when an electronic, mechanical, or hydraulic (flow path) failure occurs which requires attention before the analysis can be continued (for example, repair, or exchange of consumables is necessary). In the event of such a failure, the red status indicator at the front of the module is switched on, and an entry is written into the instrument logbook.

General Error Messages

General error messages are generic to all Agilent 1200 Infinity Series modules.

Timeout

The timeout threshold was exceeded.

Probable cause	Suggested actions
1 The analysis was completed successfully, and the timeout function switched off the pump as requested.	Restart the analysis where required.
2 A not-ready condition was present during a sequence or multiple-injection run for a period longer than the timeout threshold.	Check the logbook for the occurrence and source of a not-ready condition.

Shut-Down

An external instrument has generated a shut-down signal on the remote line. The detector continually monitors the remote input connectors for status signals. A LOW signal input on pin 4 of the remote connector generates the error message.

Probable cause	Suggested actions
1 Leak detected in another module with a CAN connection to the system.	Fix the leak in the external instrument before restarting the module.
2 Leak detected in an external instrument with a remote connection to the system.	Fix the leak in the external instrument before restarting the module.
3 Shut-down in an external instrument with a remote connection to the system.	Check external instruments for a shut-down condition.
4 The degasser failed to generate sufficient vacuum for solvent degassing.	Check the vacuum degasser for an error condition. Refer to the *Service Manual* for the degasser or the 1260 pump that has the degasser built-in.

Remote Timeout

A not-ready condition is still present on the remote input. When an analysis is started, the system expects all not-ready conditions (for example, a not-ready condition during detector balance) to switch to run conditions within one minute of starting the analysis. If a not-ready condition is still present on the remote line after one minute the error message is generated.

Probable cause	Suggested actions
1 Not-ready condition in one of the instruments connected to the remote line.	Ensure the instrument showing the not-ready condition is installed correctly, and is set up correctly for analysis.
2 Defective remote cable.	Exchange the remote cable.
3 Defective components in the instrument showing the not-ready condition.	Check the instrument for defects (refer to the instrument's documentation).

Synchronization Lost

During an analysis, the internal synchronization or communication between one or more of the modules in the system has failed. The system processors continually monitor the system configuration. If one or more of the modules is no longer recognized as being connected to the system, the error message is generated.

Probable cause	Suggested actions
1 CAN cable disconnected.	• Ensure all the CAN cables are connected correctly. • Ensure all CAN cables are installed correctly.
2 Defective CAN cable.	Exchange the CAN cable.
3 Defective main board in another module.	Switch off the system. Restart the system, and determine which module or modules are not recognized by the system.

Leak

A leak was detected in the detector. The signals from the two temperature sensors (leak sensor and board-mounted temperature-compensation sensor) are used by the leak algorithm to determine whether a leak is present. When a leak occurs, the leak sensor is cooled by the solvent. This changes the resistance of the leak sensor which is sensed by the leak-sensor circuit on the VWM board.

Probable cause	Suggested actions
1 Loose fittings.	Ensure all fittings are tight.
2 Broken capillary.	Exchange defective capillaries.
3 Leaking flow cell.	Exchange flow cell components.

Leak Sensor Open

The leak sensor in the detector has failed (open circuit). The current through the leak sensor is dependent on temperature. A leak is detected when solvent cools the leak sensor, causing the leak-sensor current to change within defined limits. If the current falls outside the lower limit, the error message is generated.

Probable cause	Suggested actions
1 Leak sensor not connected to the VWM board.	Ensure the leak sensor is connected correctly.
2 Defective leak sensor.	Exchange the leak sensor.

Leak Sensor Short

The leak sensor in the detector has failed (short circuit). The current through the leak sensor is dependent on temperature. A leak is detected when solvent cools the leak sensor, causing the leak-sensor current to change within defined limits. If the current increases above the upper limit, the error message is generated.

Probable cause	Suggested actions
1 Defective leak sensor.	Exchange the leak sensor.

Compensation Sensor Open

The ambient-compensation sensor (NTC) on the VWM board in the detector has failed (open circuit). The resistance across the temperature compensation sensor (NTC) on the VWM board is dependent on ambient temperature. The change in resistance is used by the leak circuit to compensate for ambient temperature changes. If the resistance across the sensor increases above the upper limit, the error message is generated.

Probable cause	Suggested actions
1 Defective VWM board	Exchange the main board.

Compensation Sensor Short

The ambient-compensation sensor (NTC) on the VWM board in the detector has failed (short circuit).

The resistance across the temperature compensation sensor (NTC) on the VWM board is dependent on ambient temperature. The change in resistance is used by the leak circuit to compensate for ambient temperature changes. If the resistance across the sensor falls below the lower limit, the error message is generated.

Probable cause	Suggested actions
1 Defective VWM board	Exchange the main board.

Fan Failed

The cooling fan in the detector has failed.

The hall sensor on the fan shaft is used by the VWM board to monitor the fan speed. If the fan speed falls below two revolutions/second for more than five seconds, the error message is generated.

Probable cause	Suggested actions
1 Fan cable disconnected.	Ensure the fan is connected correctly.
2 Defective fan.	Exchange fan.
3 Defective main board.	Exchange the main board.

Open Cover

The top foam has been removed.

The sensor on the VWM board detects when the top foam is in place. If the foam is removed during operation, the lamp and grating drive power is switched off, and the error message is generated.

Probable cause	Suggested actions
1 Top foam removed.	Replace the foam.

Detector Error Messages

These errors are detector specific.

Lamp Current Missing

The lamp anode current is missing. The processor continually monitors the anode current drawn by the lamp during operation. If the anode current falls below the lower current limit, the error message is generated.

Probable cause	Suggested actions
1 Lamp disconnected.	Ensure the lamp connector is seated firmly.
2 Top foam removed while lamp is on.	Replace the top foam, and turn ON the lamp.
3 Defective or non-Agilent lamp.	Exchange the lamp.
4 Defective VWM board	Exchange the VWM board.
5 Defective power supply.	Exchange the power supply.

Lamp Voltage Missing

The lamp anode voltage is missing. The processor continually monitors the anode voltage across the lamp during operation. If the anode voltage falls below the lower limit, the error message is generated.

Probable cause	Suggested actions
1 Defective or non-Agilent lamp.	Exchange the lamp.
2 Defective power supply.	Exchange the power supply.
3 Defective VWM board	Exchange the VWM board.

Lamp Ignition Failed

The lamp failed to ignite. The processor monitors the lamp current during the ignition cycle. If the lamp current does not rise above the lower limit within 2 – 5 seconds, the error message is generated.

Probable cause	Suggested actions
1 Lamp disconnected.	Ensure the lamp is connected.
2 Defective or non-Agilent lamp.	Exchange the lamp.
3 Defective power supply.	Exchange the power supply.
4 Defective VWM board	Exchange the VWM board.

Heater Current Missing

The lamp heater current in the detector is missing. During lamp ignition, the processor monitors the heater current. If the current does not rise above the lower limit within one second, the error message is generated.

Probable cause	Suggested actions
1 Lamp disconnected.	Ensure the lamp is connected.
2 Ignition started without the top foam in place.	Replace the top foam, and turn on the lamp.
3 Defective VWM board	Exchange the VWM board.
4 Defective or non-Agilent lamp.	Exchange the lamp.
5 Defective power supply.	Exchange the power supply.

Calibration Failed

The intensity maximum was not found during wavelength calibration.

Calibration 0 Failed: Zero-order calibration failed.

Calibration 1 Failed: 656 nm calibration failed.

During zero-order and 656 nm calibration, the detector searches for the intensity maximum. If the maximum is not detected within the scan range, the error message is generated.

	Probable cause	Suggested actions
1	Lamp is OFF.	Switch on the lamp.
2	Incorrect flow cell installation.	Ensure the flow cell are installed correctly.
3	Flow cell contamination or air bubbles.	Clean/replace flow cell windows or remove air bubbles.
4	Intensity too low.	Replace lamp.
5	Current step value too far from maximum.	Enter a different calibration step value (different scan range). Repeat the calibration.
6	Misaligned/defective grating assembly.	Run the grating-motor test to determine if the grating assembly is defective. If defective, replace the optical unit.
7	ProbableCause?	Exchange the VWM board.

Holmium Oxide Test Failed

The holmium oxide test in the detector has failed. During the holmium test, the detector moves the holmium filter into the light path, and compares the measured absorbance maxima of the holmium oxide filter with expected maxima. If the measured maxima are outside the limits, the error message is generated.

Probable cause	Suggested actions
1 Misaligned/defective grating assembly.	• Ensure the flow cell is inserted correctly, and is free from contamination (cell windows, buffers, and so on). • Run the filter-motor test to determine if the grating motor assembly is defective. Exchange the filter motor assembly. • Run the grating-motor test to determine if the grating assembly is defective. If defective, replace the optical unit.

Grating/Filter Motor Test Failed

The motor test has failed.

Test 0 Failed: Filter motor.

Test 1 Failed: Grating motor

During the motor tests, the detector moves the motor to the end position while monitoring the end-position sensor. If the end position is not found, the error message is generated.

Probable cause	Suggested actions
1 Defective motor assembly.	Run the grating-motor test to determine if the grating assembly is defective. If defective, replace the optical unit.

Wavelength Check Failed

The automatic wavelength check after lamp ignition has failed. When the lamp is switched on, the detector waits 1 minute to warm-up the lamp. Then a check of the deuterium emission line (656 nm) via the reference diode is performed. If the emission line is more than 3 nm away from 656 nm, the error message is generated.

Probable cause	Suggested actions
1 Calibration incorrect.	Recalibrate the detector.

Filter Check Failed

The automatic filter check after lamp ignition has failed. When the lamp is switched on, the detector moves the cutoff filter into the light path. If the filter is functioning correctly, a decrease in lamp intensity is seen. If the expected intensity decrease is not detected, the error message is generated.

Probable cause	Suggested actions
1 Filter motor defective.	Run the filter motor test to determine if the motor is defective.
2 Defective or missing filter.	Exchange the filter assembly.

7 Error Information

8
Test Functions

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This chapter describes the detector's built in test functions.

Available Tests versus Interfaces

Depending on the user interface the available tests vary. All test descriptions are based on the Agilent LabAdvisor as user interface.

Table 24 Available Tests versus Interface

Interface Test	LabAdvisor	ChemStation	Instant Pilot G4208A
Wavelength Verification/Re-calibration	Calibration (*)	Tests (*)	Maintenance (*)
Lamp Intensity Test	Tests (*)	Tests (*)	Diagnosis (*)
ASTM Drift and Noise Test	Tests (*)	n/a	n/a
Quick Noise Test	Tests (*)	n/a	n/a
Holmium Test	Tests (*)	Tests (*)	Diagnosis (*)
Cell Test	Tests (*)	Tests (*)	n/a
D/A Converter Test	Tests (*)	Tests (*)	n/a
Dark Current Test	Tests (*)	Tests (*)	n/a
Filter / Grating Motor Test	Tests (*)	Tests (*)	n/a
Test Chromatogram	Tools	from command line	n/a
Spectrum (Blank, Sample, Holmium)	Tools	n/a	n/a

(*) interface provides passed/fail information or a plot.

Intensity Test

The intensity test measures the intensity of the deuterium lamp over the full VWD wavelength range (190 – 600 nm). The test can be used to determine the performance of the lamp, and to check for dirty or contaminated flow cell windows. When the test is started, the gain is set to zero. To eliminate effects due to absorbing solvents, the test should be done with water in the flow cell. The shape of the intensity spectrum is primarily dependent on the lamp, grating, and diode characteristics. Therefore, intensity spectra will differ slightly between instruments. Figure 34 on page 116 shows a typical intensity test spectrum.

The test is available in

- Agilent LabAdvisior (preferred)
- Agilent ChemStation
- Instant Pilot (G4208A) via **More-Diagnosis-VWD-Lamp Intensity Test**.

Intensity Test Evaluation

The Agilent Lab Advisor and the Instant Pilot evaluate three values automatically and display the limits for each value, the average, the minimum and the maximum of all data points and **passed** or **failed** for each value.

Instensity Test with Agilent LabAdvisor

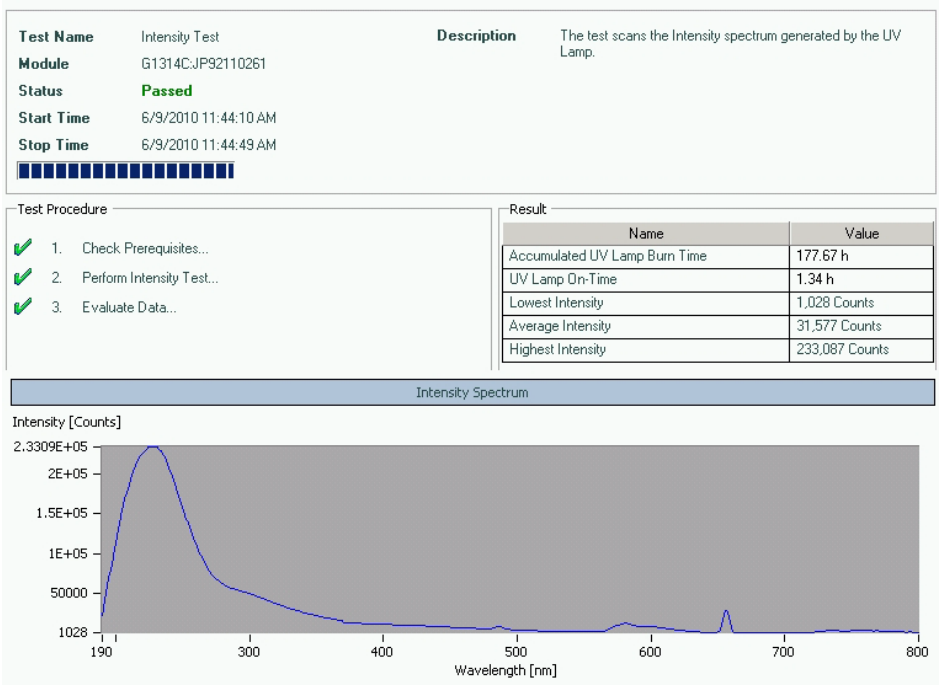


Figure 34 Intensity Test with Agilent LabAdvisor

Intensity Test Failed

Probable cause	Suggested actions
1 Empty flow cell	Ensure the flow cell is filled with water.
2 Flow cell windows dirty	Repeat the test with the flow cell removed. If the test passes, exchange the flow cell windows.
3 Optics defect	Clean/replace optical components.
4 Defective lamp or optics.	Exchange the lamp.

Checking the Photocurrent

To identify problems with the flow cell (contaminated windows, air bubbles and so on) you can use raw data from the sample and reference photodiode (unfiltered and not logarithmic).

The photocurrent information (RAW SAMPLE/REFERENCE) is available in

- Agilent Instant Pilot G4208A, via **More-Diagnosis-VWD-LampIntensity Test**

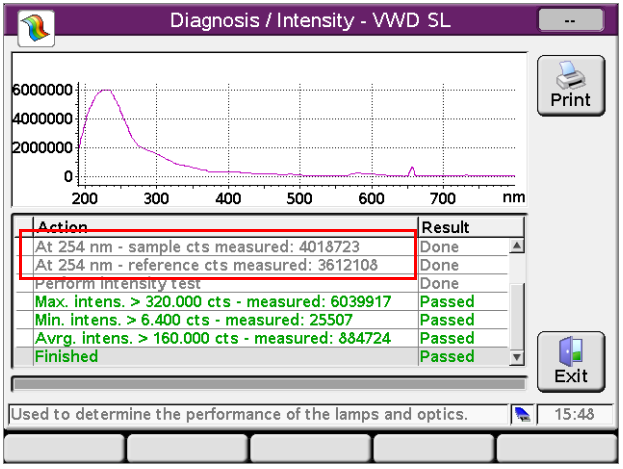


Figure 35 Photocurrent readings with Instant Pilot

Photocurrent Evaluation

With a clean cell the counts for sample and reference are in the same range. If, like in this example, the sample side shows much less, the flow cell might have a problem due to

- dirty windows,
- absorbing solvents/compounds,
- not correctly mounted flow cell, or
- air bubbles

Wavelength Verification/Calibration

Wavelength calibration of the detector is done using the zero-order position and 656 nm emission line position of the deuterium lamp. The calibration procedure involves two steps. First the grating is calibrated on the zero-order position. The stepper-motor step position where the zero-order maximum is detected is stored in the detector. Next, the grating is calibrated against the deuterium emission-line at 656 nm, and the motor position at which the maximum occurs is stored in the detector.

In addition to the zero-order and 656 nm (alpha-emission line) calibration, the beta-emission line at 486 nm and the three holmium lines are used for the complete wavelength calibration process. These holmium lines are at 360.8 nm, 418.5 nm and 536.4 nm.

This function is available in

- Agilent LabAdvisior (preferred)
- Agilent ChemStation
- Instant Pilot (G4208A)

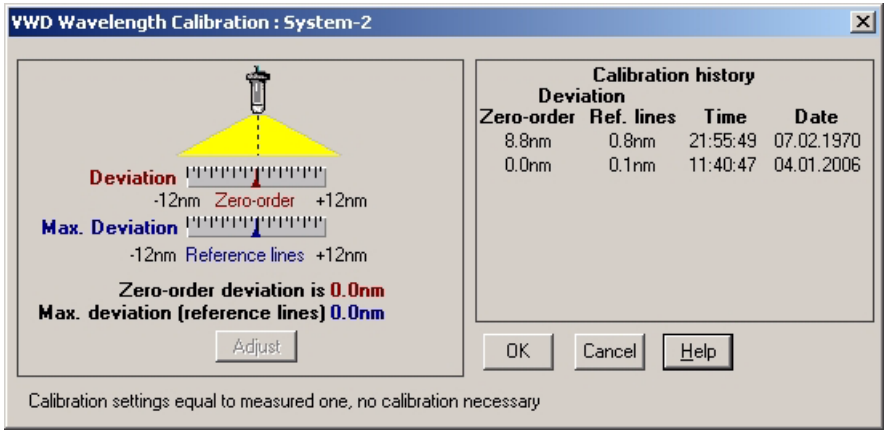


Figure 36 Wavelength Verification/Calibration (Agilent ChemStation)

NOTE The wavelength verification/calibration takes about 2.5 minutes and is disabled within the first 10 minutes after ignition of the lamp because initial drift may distort the measurement.

When the lamp is turned ON, the 656 nm emission line position of the deuterium lamp is checked automatically, see "Lamp-on Routine" on page 120.

When to Calibrate the Detector

The detector is calibrated at the factory, and under normal operating conditions should not require recalibration. However, it is advisable to recalibrate:

- after maintenance (flow cell or lamp),
- after repair of components in the optical unit,
- after exchange of the optical unit or VWM board,
- at a regular interval, at least once per year (for example, prior to an Operational Qualification/Performance Verification procedure), and
- when chromatographic results indicate the detector may require recalibration.

Zero-Order Calibration

The zero-order calibration function is used for the electrical calibration of the zero-order beam of the monochromator.

The grating is driven by the stepper motor while the detector searches for the intensity maximum occurring at the zero-order position. The zero-order calibration values are stored in the instrument.

The deviation is displayed in nm on the user interface, see Figure 36 on page 118.

656-nm Wavelength Calibration

The wavelength calibration function is used to calibrate the monochrometer against the 656 nm emission line of the deuterium lamp.

The detector searches for maximum light intensity in the region of the 656 nm emission line. The 656 nm calibration values are stored in the instrument.

The deviation is displayed in nm on the user interface, see Figure 36 on page 118.

Lamp-on Routine

When the lamp is turned on the following routine is implemented:

- During the ignition phase the grating position is reinitialize by moving the grating position lever into the sensor position.
- After ignition, a 1-minute warm-up phase should stabilize the lamp.
- Check of wavelength setting at 656 nm emission line (must be within 3 nm). This measurement is taken at the reference side only (to have no influence from flow cell condition). If not correct then a message for recalibration is displayed.
- Intensity check:

  at 250 nm without cutoff filter (= value 1).

  at 250 nm with cutoff filter (= value 2).

  The result should be value 2 < value 1/16.
  If not OK, the cutoff filter does not work correctly.
- Restore the set wavelength position.
- The detector should now be ready condition.

Wavelength Verification/Calibration with Agilent LabAdvisor

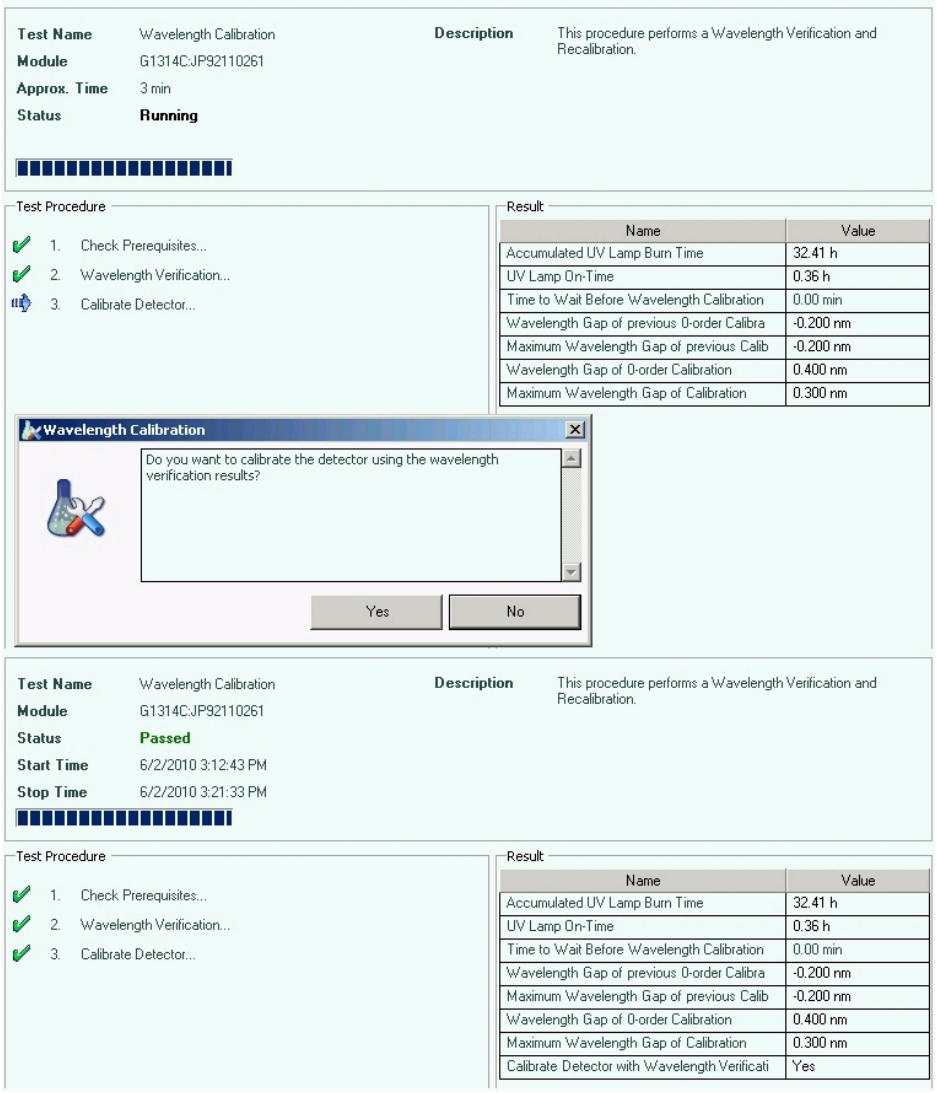


Figure 37 Wavelength Verification and Calibration (Agilent LabAdvisor)

ASTM Drift and Noise Test

The ASTM Drift and Noise test determines the detector noise over a period of 20 minutes. The test is done with HPLC-grade water flowing through the flow cell at 1 mL/min. On completion of the test, the noise result is displayed automatically.

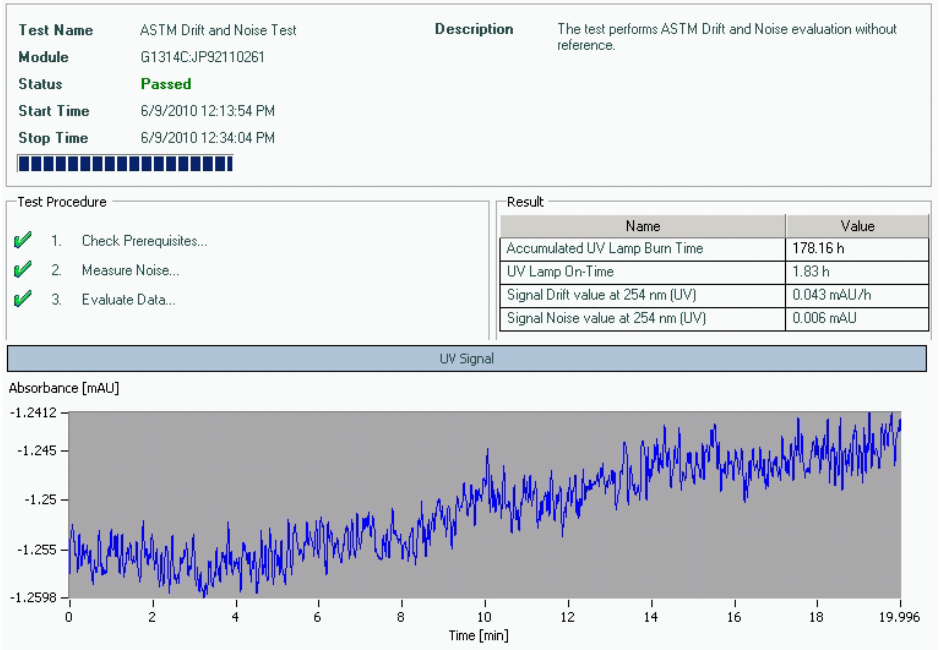


Figure 38 ASTM Drift and Noise Test (Agilent LabAdvisor)

Quick Noise Test

The noise test measures the noise of the detector, with HPLC-grade water flowing through the flow cell at 1 mL/min, in one minute intervals over a total of 5 minutes.

The noise of the detector is calculated by using the maximum amplitude for all random variations of the detector signal of frequencies greater than one cycle per hour. The noise is determined for 5 one minute intervals and is based on the accumulated peak-to-peak noise for the intervals. At least seven data points per cycles are used in the calculation.

The cycles in the noise determination are not overlapping.

In order to obtain reliable results, the lamp should be turned on for at least 10 minutes prior to measurement.

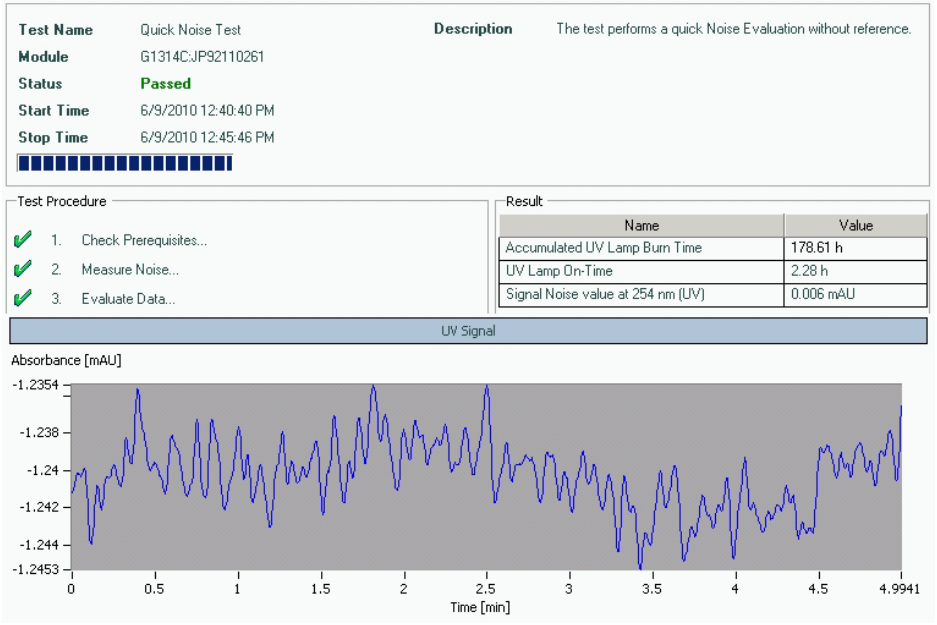


Figure 39 Quick Noise Test (Agilent LabAdvisor)

Dark Current Test

The dark-current test measures the leakage current from the sample and reference circuits. The test is used to check for defective sample or reference diodes or ADC circuits which may cause non-linearity or excessive baseline noise. During the test, the lamp is switched off. Next, the leakage current from both diodes is measured.

When to do the Test

- if the detector signal is noisy.

Interpreting the Results

The output signal of the ADC noise corresponds to AD counts with 1 V or 0.1 V full scale setting. The ADC noise must be taken over a time of 10 minutes for the results to be accepted.

Average counts should be less than 7900 counts

Dark Current Test Failed

Probable Causes	Suggested Actions
1 Defective sample or reference diode.	Exchange optical unit.
2 Defective sample or reference VWA board.	Exchange optical unit.
3 Defective VWM board.	Exchange the VWM board.

Dark Current Test with Agilent LabAdvisor.

Figure 40 Dark Current Test (Agilent LabAdvisor)

Holmium Oxide Test

This test verifies the calibration of the detector against the three wavelength maxima of the built-in holmium oxide filter. The test displays the difference between the expected and measured maxima. Figure 41 shows a holmium test spectrum.

The test is available in

- Agilent LabAdvisor (preferred)
- Instant Pilot (G4208A), via **More-Diagnosis-VWD-Holmium Spectrum Test**

The test uses the following holmium maxima:

- 360.8 nm
- 418.5 nm
- 536.4 nm

NOTE See also "Declaration of Conformity for HOX2 Filter" on page 195.

When to do the Test

- after recalibration,
- as part of the Operational Qualification/Performance Verification procedure, or
- after flow cell maintenance or repair.

Interpreting the Results

The test is passed successfully when all three wavelengths are within ± 1 nm of the expected value. This indicates the detector is calibrated correctly.

NOTE ChemStation revisions below B.01.xx show a limit of ± 2 nm. It should read ± 1 nm. If the test shows a value greater than ± 1 nm, perform a recalibration.

Running the test with Agilent LabAdvisor

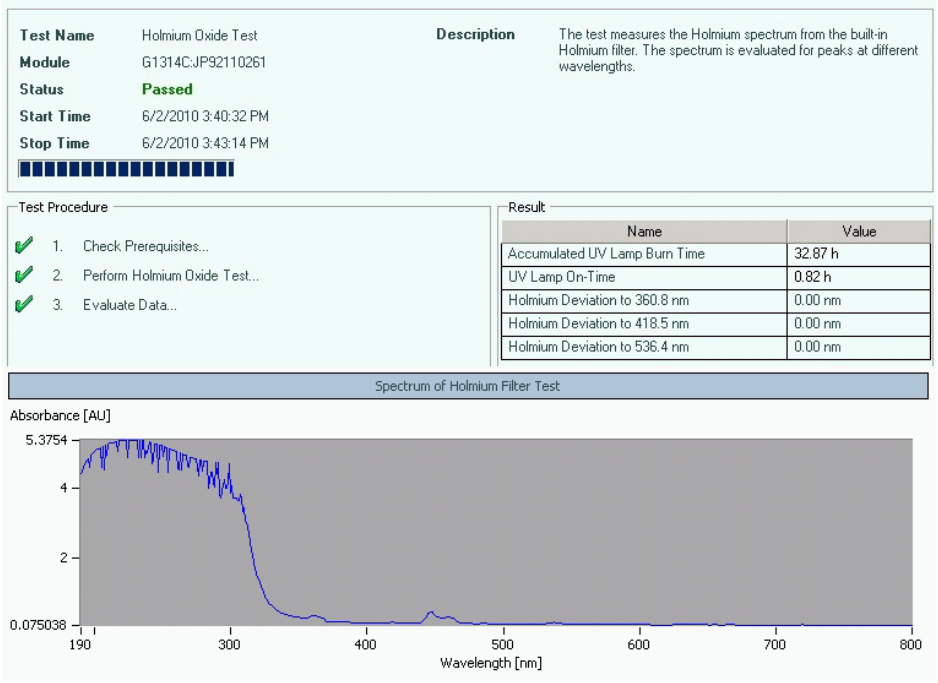


Figure 41 Holmium Test with Agilent LabAdvisor

Holmium Oxide Test Failed

Probable Causes	Suggested Actions
1 Detector not calibrated.	Recalibrate the detector.
2 Dirty or defective flow cell.	Repeat the test with the flow cell removed. If the test is OK, exchange the flow cell components.
3 Dirty or defective holmium oxide filter.	Run the holmium oxide filter test. If the test fails, exchange the filter assembly.
4 Optical misalignment.	Replace the optical unit.

D/A Converter (DAC)Test

The detector provides analog output of chromatographic signals for use with integrators, chart recorders or data systems. The analog signal is converted from the digital format by the digital-analog-converter (DAC).

The DAC test is used to verify correct operation of the digital-analog-converter by applying a digital test signal to the DAC.

The DAC outputs an analog signal of approximately 50 mV (if the zero offset of the analog output is set to the default value of 5 %) which can be plotted on an integrator. A continuous square wave with an amplitude of 10 µV and a frequency of approximately 1 cycle/24 seconds is applied to the signal.

The amplitude of the square wave and the peak-to-peak noise are used to evaluate the DAC test.

The test is available in

- Agilent LabAdvisior (preferred)
- Instant Pilot (G4208A)

When to do the Test

- if the detector signal is noisy or missing.

Running the test with Agilent LabAdvisor

1 Run the D/**A Converter (DAC) Test** (for further information see Online-Help of user interface).

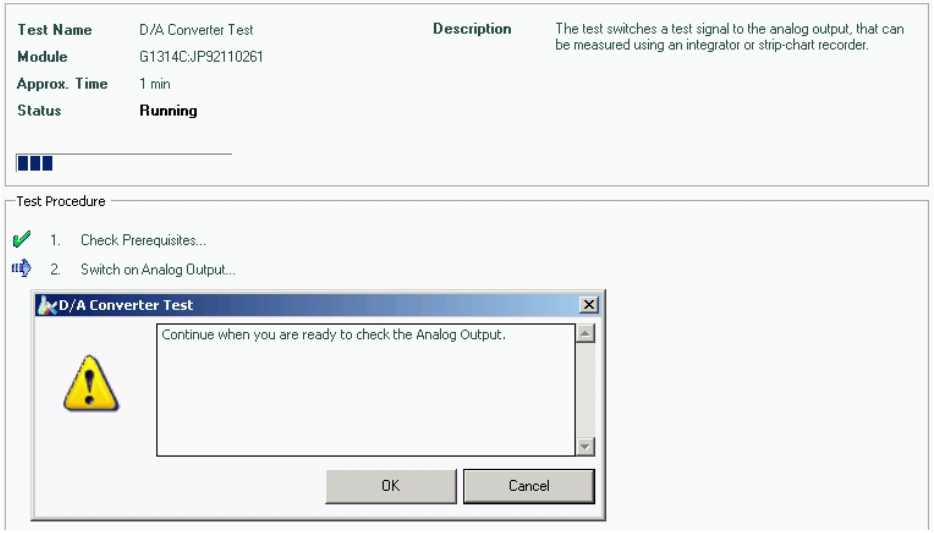


Figure 42 D/C Test with Agilent LabAdvisor

2 Observe the analog output signal.

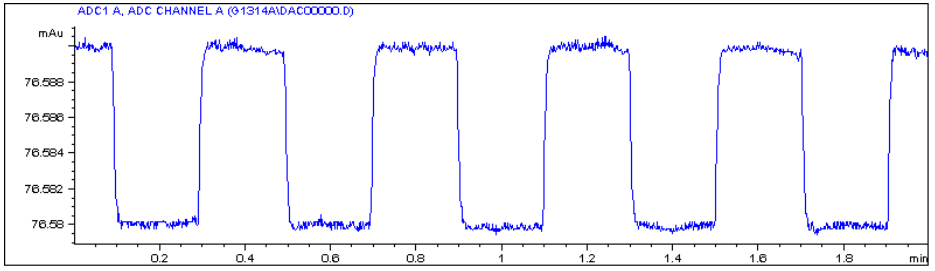


Figure 43 D/A Converter (DAC) Test – Example of Integrator Plot

Running the Test with Instant Pilot

The test can be started via the command line.

1 To start the test

TEST: DAC 1

Reply: RA 00000 TEST:DAC 1

2 To stop the test

TEST:DAC 0

Reply: RA 00000 TEST:DAC 0

Test Failed

The noise on the step should be less than 3 µV.

Probable cause	Suggested actions
1 Bad cable or grounding problem between detector and external device.	Check or replace the cable.
2 Defective detector main board.	Exchange the detector main board.

Grating and Filter Motor Test

This test moves the grating motor to the end position, and displays the motor-position step difference. This checks the movement of the grating drive mechanism.

The test is available in

- Agilent LabAdvisior (preferred)
- Agilent ChemStation

When to do the Test

- if recalibration cannot be done successfully, or
- if the holmium test fails.

Filter/Grating Motor Test with Agilent LabAdvisor

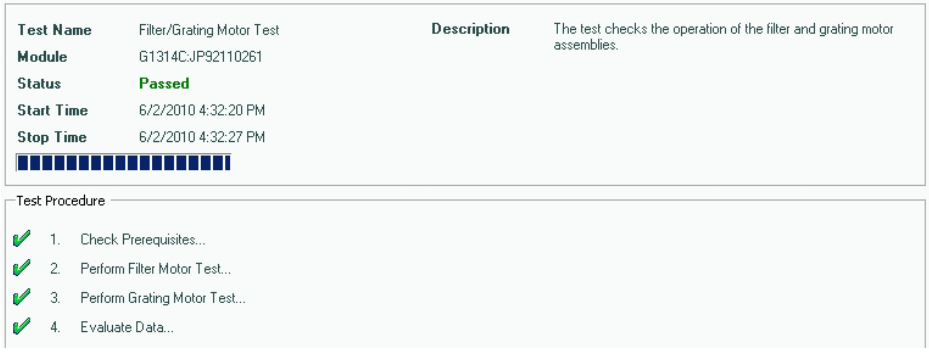


Figure 44 Grating and Filter Motor Test with Agilent LabAdvisor

Filter/Grating Motor Test with Instant Pilot

The test can be started via the command line.

- To start the test

  TEST:GRAT or

  TEST:FILT

  Reply: RA 00000 TEST:GRAT or RA 00000 TEST:FILT
- Test succeeded (when passed)

Grating Motor Test Failed

Probable cause	Suggested actions
1 Defective grating motor	Exchange Optical Unit.
2 Defective grating position sensor	Exchange Optical Unit.
3 Defective VWM board	Exchange the VWM board

Filter Motor Test Failed

Probable cause	Suggested actions
1 Defective filter motor	Exchange Optical Unit.
2 Defective filter position sensor	Exchange Optical Unit.
3 Defective VWM board	Exchange the VWM board

Test Chromatogram

This function is available from the Agilent Lab Advisor.

The built-in test chromatogram can be used to check the signal path from the detector to the data system or via the analog output to the integrator or data system. An example is shown in the figure below. The chromatogram is continuously repeated until a stop is executed either by means of a stop time or manually.

NOTE The peak height is always the same but the area and the retention time depend on the set peakwidth, see examples below.

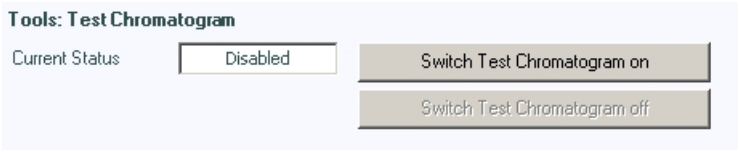
Procedure Using the Agilent LabAdvisor

This procedure works for all Agilent 1200 Infinity detectors (DAD, MWD, VWD, FLD and RID). The example figure is from the RID detector.

1 Assure that the default LC method is loaded via the control software.

2 Start the Agilent LabAdvisor software (B.01.03 SP4 or later) and open the detector's **Tools** selection.

3 Open the test chromatogram screen



4 Turn the **Test Chromatogram** on.

5 Change to the detector's **Module Service Center** and add the detector signal to the Signal Plot window.

6 To start a test chromatogram enter in the command line: **STRT**

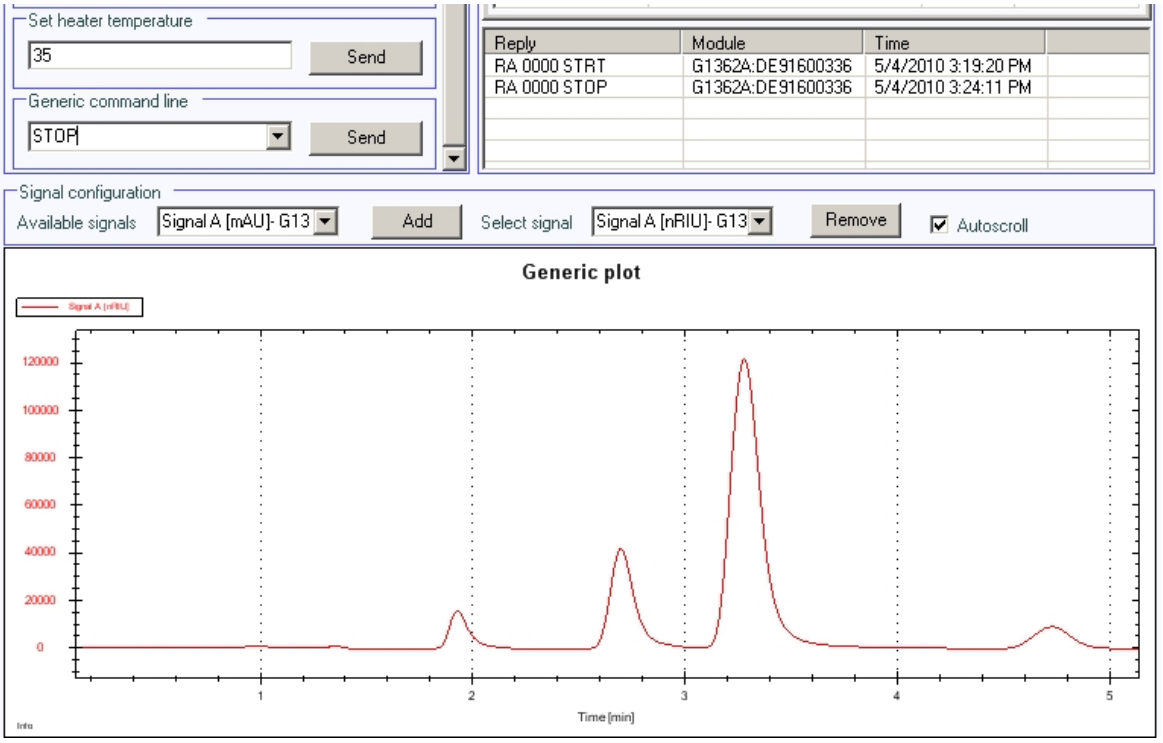


Figure 45 Test Chromatogram with Agilent LabAdvisor

7 To stop the test chromatogram enter in the command line: **STOP**

NOTE The test chromatogram is switched off automatically at the end of a run.

9
Maintenance and Repair

Introduction to Maintenance 136
Warnings and Cautions 137

This chapter provides general information on maintenance and repair of the detector.

Introduction to Maintenance

The module is designed for easy repair. The most frequent repairs such as lamp change and flow cell change can be done from the front with the module in place in the system stack.

Warnings and Cautions

WARNING

Module is partially energized when switched off, as long as the power cord is plugged in.

Risk of stroke and other personal injury. Repair work at the module can lead to personal injuries, e. g. shock hazard, when the module cover is opened and the instrument is connected to power.

→ Never perform any adjustment, maintenance or repair of the module with the top cover removed and with the power cord plugged in.

→ The security lever at the power input socket prevents that the module cover is taken off when line power is still connected. Never plug the power line back in when cover is removed.

WARNING

Sharp metal edges

Sharp-edged parts of the equipment may cause injuries.

→ To prevent personal injury, be careful when getting in contact with sharp metal areas.

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

The handling of solvents, samples and reagents can hold health and safety risks.

→ When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor and follow good laboratory practice.

→ The amount of substances should be reduced to the minimal volume required for the analysis.

→ Do not operate the instrument in an explosive atmosphere.

CAUTION

Electronic boards and components are sensitive to electrostatic discharge (ESD).

ESD can damage electronic boards and components.

→ Be sure to hold the board by the edges and do not touch the electrical components. Always use an ESD protection (for example, an ESD wrist strap) when handling electronic boards and components.

WARNING

Eye damage by detector light

Eye damage may result from directly viewing the UV-light produced by the lamp of the optical system used in this product.

→ Always turn the lamp of the optical system off before removing it.

CAUTION

Safety standards for external equipment

→ If you connect external equipment to the instrument, make sure that you only use accessory units tested and approved according to the safety standards appropriate for the type of external equipment.

10 Maintenance

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Replacing the Detector's Firmware 157

This chapter describes the maintenance of the detector.

Overview of Maintenance

The following pages describe maintenance (simple repairs) of the detector that can be carried out without opening the main cover.

Table 25 Simple Repairs

Procedures	Typical Frequency	Notes
Deuterium lamp exchange	If noise and/or drift exceeds your application limits or lamp does not ignite.	A VWD test should be performed after replacement.
Flow cell exchange	If application requires a different flow cell type.	A VWD test should be performed after replacement.
Cleaning flow cell parts cleaning or exchange	If leaking or if intensity drops due to contaminated flow cell windows.	A pressure tightness test should be done after repair.
Leak sensor drying	If leak has occurred.	Check for leaks.
Leak handling system replacement	If broken or corroded.	Check for leaks.

Cleaning the Module

The module case should be kept clean. Cleaning should be done with a soft cloth slightly dampened with water or a solution of water and mild detergent. Do not use an excessively damp cloth allowing liquid to drip into the module.

WARNING

Liquid dripping into the electronic compartment of your module.

Liquid in the module electronics can cause shock hazard and damage the module.

→ Do not use an excessively damp cloth during cleaning.

→ Drain all solvent lines before opening any fittings.

Exchanging a Lamp

When required	If noise or drift exceeds application limits or lamp does not ignite.
Tools required	Screwdriver POZI 1 PT3
Parts required	Deuterium lamp G1314-60100

NOTE If you want to use the Agilent DAD lamp instead of the VWD lamp, you have to change the lamp settings in the *VWD Configuration* to lamp type *2140-0590*. This ensures that the DAD lamp's filament heating is operated like in the DAD.

NOTE The instrument specifications are based on the VWD lamp.

WARNING

Injury by touching hot lamp

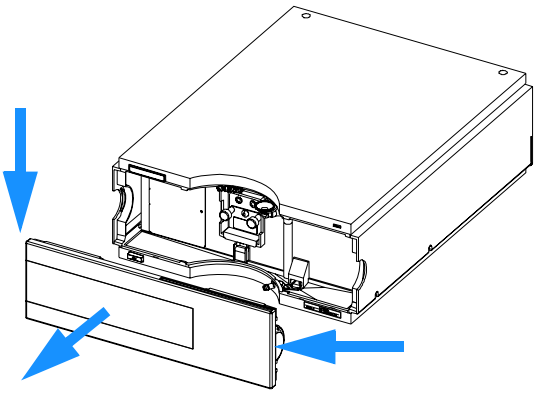
If the detector has been in use, the lamp may be hot.

→ If so, wait for lamp to cool down.

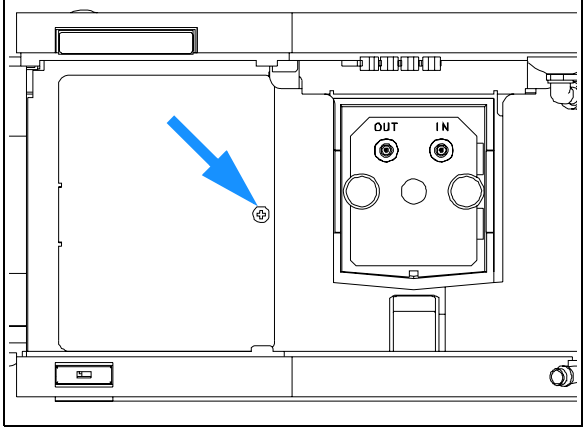
Preparations for this procedure:

- Turn the lamp OFF.

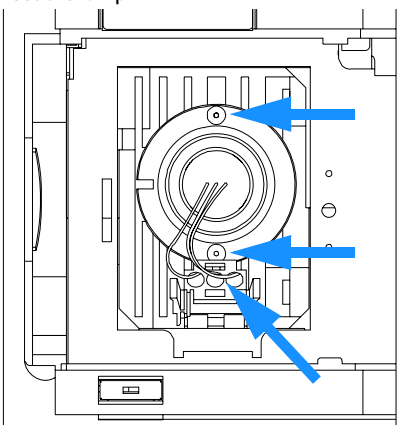
1 Press the release buttons and remove the front cover to have access to the lamp area.



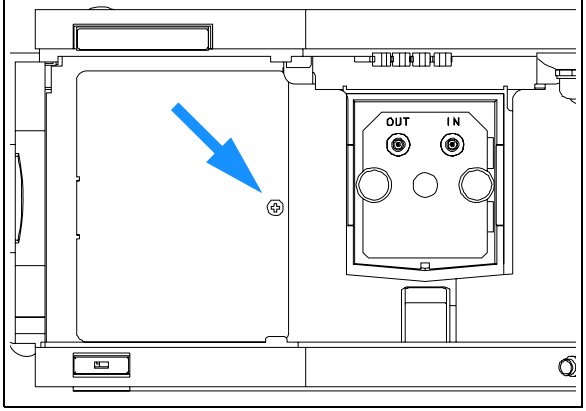
8 Unscrew the lamp cover and remove it.



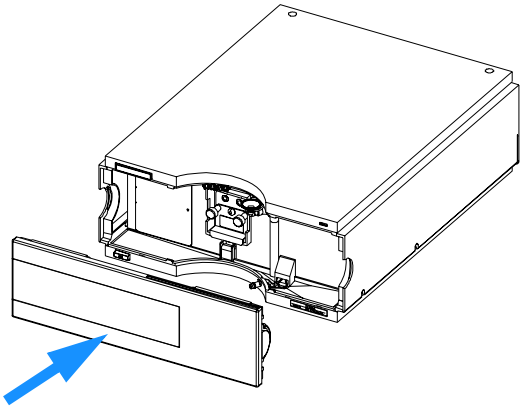
9 Unscrew, disconnect and replace the lamp. Insert, fix and reconnect the lamp.



10 Replace the lamp cover.



11 Replace the front cover.



Next steps:

- Reset the lamp counter as described in the User Interface documentation.
- Turn the lamp ON.
- Give the lamp more than 10 minutes to warm-up.
- Perform "Wavelength Verification/Calibration" on page 118 to check the correct positioning of the lamp.

Exchanging a Flow Cell

When required If application needs a different type of flow cell or the flow cell needs repair.

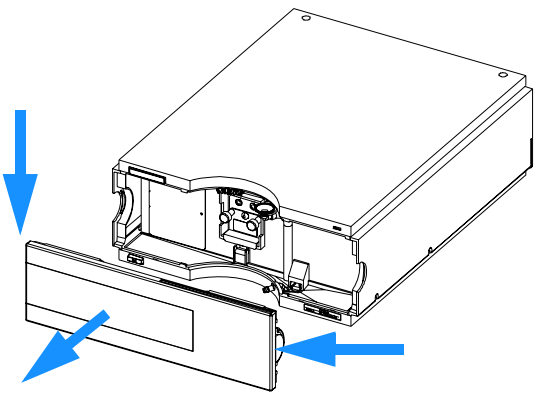
Tools required Two 1/4 inch wrenches for capillary connections

Parts required G1314-60086 10 mm, 14 µL, 40 bar,
Micro flow cell, 5 mm, 1 µL, 40 bar, G1314-60081
Semimicro flow cell, 6 mm, 5 µL, 40 bar, G1314-60083
High pressure flow cell, 10 mm, 14 µL, 400 bar, G1314-60082

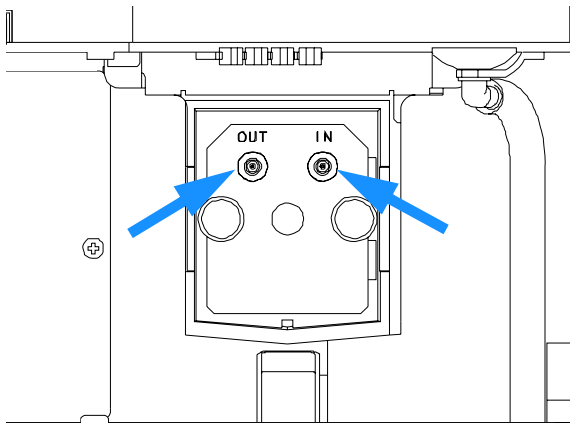
Preparations for this procedure:

- Turn the lamp OFF.

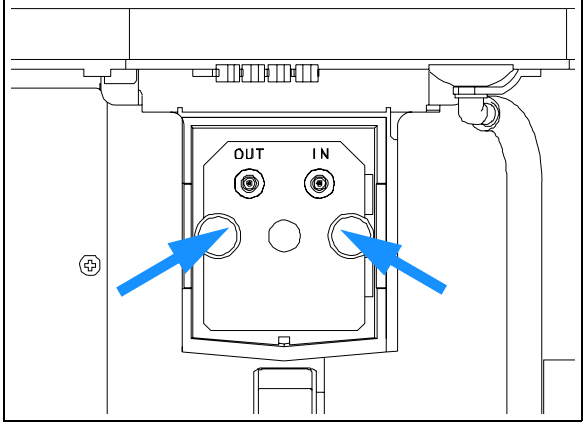
1 Press the release buttons and remove the front cover to have access to the flow cell area.



2 Disconnect the inlet and outlet capillaries.



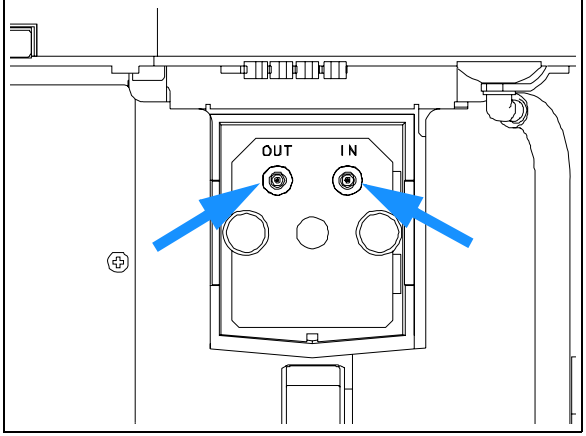
3 Unscrew the thumb screws parallel and remove the flow cell.



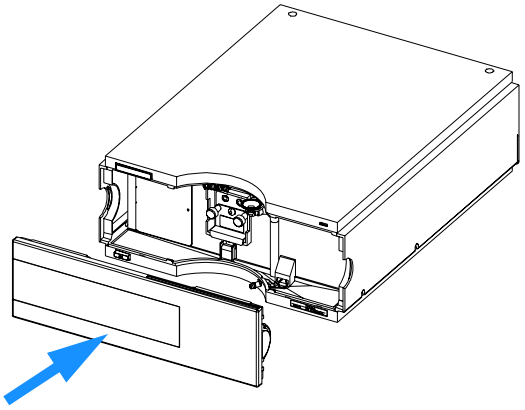
Note:

If you want to maintain flow cell parts, see "Repairing the Flow Cells" on page 148 or the information provided with your flow cell.

4 Replace the flow cell and fix the thumb screws. Reconnect the inlet and outlet capillaries to the flow cell.



5 Replace the front cover.



Next steps:

- To check for leaks, establish a flow and observe the flow cell (outside of the cell compartment) and all capillary connections.
- Insert the flow cell.
- Perform "Wavelength Verification/Calibration" on page 118 to check the correct positioning of the flow cell.
- Replace the front cover.

Repairing the Flow Cells

When required	If the flow cell needs repair due to leaks or contaminations.
Tools required	Wrench 1/4 inch for capillary connections Hexagonal wrench 4 mm Tooth picks
Parts required	See "Standard Flow Cell" on page 161. See "Micro Flow Cell" on page 162. See "Semi-micro Flow Cell" on page 163. See "High Pressure Flow Cell" on page 165.
Preparations	Turn off the flow. Remove the front cover. Remove the flow cell, see "Exchanging a Flow Cell" on page 145.

NOTE The shown cell parts will differ depending upon the flow cell type. For detailed parts schematics, refer to above mentioned pages.

1 - Cell Screw
2 - Conical Springs
3 - Ring #1 PEEK
4 - Gasket #1 (small hole)
5 - Window Quartz
6 - Gasket #2 (large hole)
7 - Cell cover assembly
8 - Ring #2 PEEK

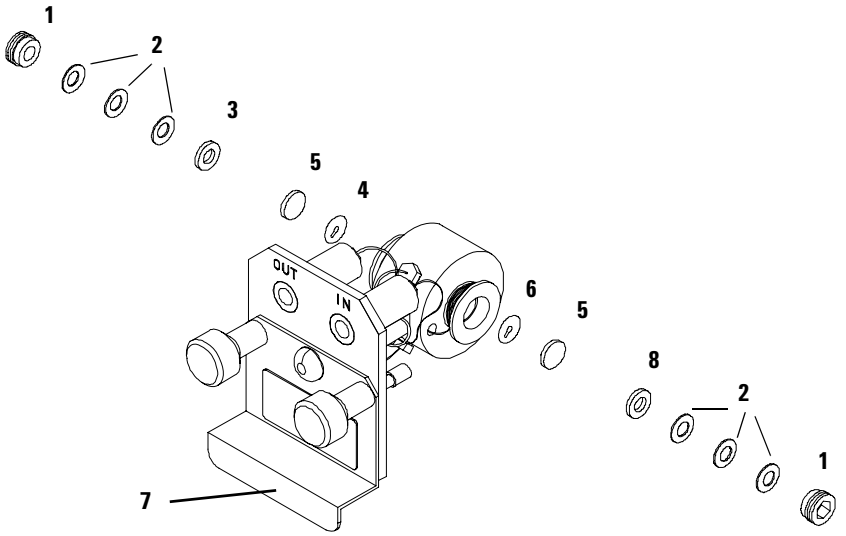


Figure 46 Standard Flow Cell

Disassembling the Flow Cell

1 Unscrew the cell screw using a 4-mm hexagonal wrench.

2 Remove the SST rings using a pair of tweezers.

3 Use adhesive tape to remove the peek ring, the window and the gasket.

CAUTION Do not use tweezers to remove windows as the surfaces can easily be scratched.

4 Repeat step 1 through step 3 for the other window (keep the parts separate - otherwise they could be mixed!).

Cleaning the Flow Cell Parts

5 Pour isopropanol into the cell hole and wipe clean with a piece of lint-free cloth.

6 Clean the windows with ethanol or methanol. Dry it with a piece of lint-free cloth.

NOTE Always use new gaskets.

Reassembling the Flow Cell

7 Hold the flow cell cassette horizontally and place gasket in position. Ensure both cell holes can be seen through the holes of gasket.

NOTE

The semi-micro #1 and #2 gaskets (items 6 and 7, "Semi-micro Flow Cell" on page 164) look very similar. Do not mix them up.

8 Place the window on gasket.

9 Place the peek ring on the window.

10 Insert the conical springs. Make sure the conical springs point towards the window. Otherwise tightening the cell screw might break the window.

11 Screw the cell screw into the flow cell and tighten the screw.

12 Repeat the procedure for the other cell side.

Next steps

- Reconnect the capillaries, see "Exchanging a Flow Cell" on page 145.
- Perform a leak test. If OK, insert the flow cell.
- Perform "Wavelength Verification/Calibration" on page 118 to check the correct positioning of the flow cell.
- Replace the front cover.

Using the Cuvette Holder

When required:	If your own standard should be used to checkout the instrument.
Tools required:	None
Parts required:	Cuvette Holder G1314-60200 Cuvette with the “standard”, e.g. NIST certified holmium oxide sample

This cuvette holder can be placed instead of a flow cell in the variable wavelength detector. Standard cuvettes with standards in it, for example, National Institute of Standards & Technology (NIST) holmium oxide solution standard, can be fixed in it.

This can be used for wavelength verifications.

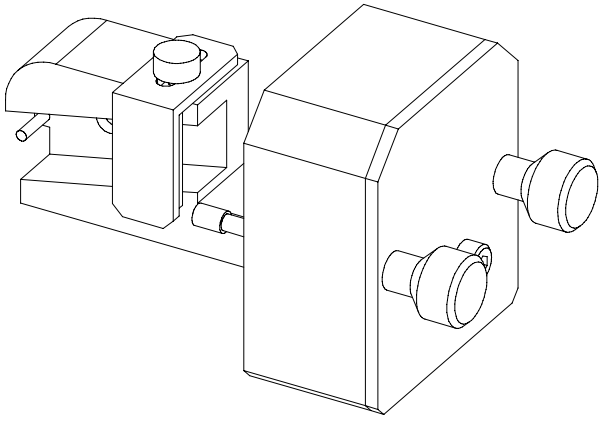
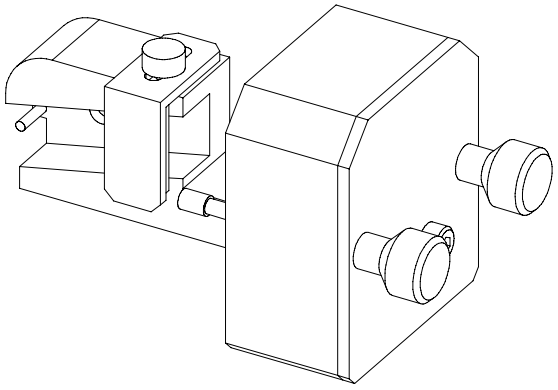


Figure 47 Cuvette Holder

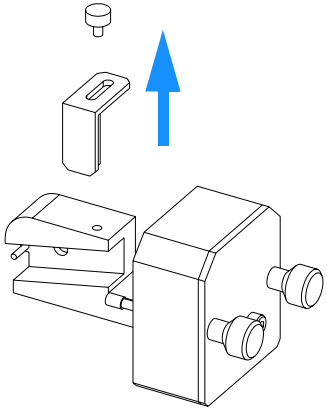
Preparation for this procedure are:

- Remove the normal flow cell.
- Have cuvette with standard available.

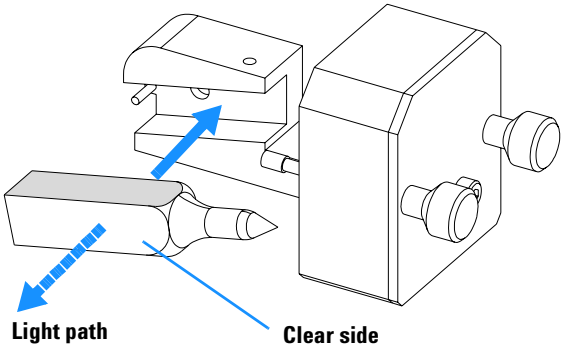
1 Locate the cuvette holder on the desk.



2 Unscrew the bracket.



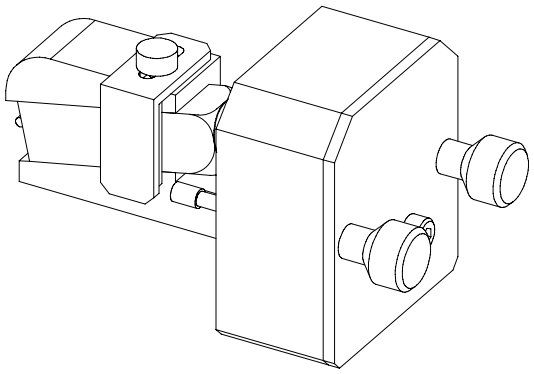
3 Insert the cuvette with the sample into the holder. The clear side of the cuvette must be visible.



Next steps:

- Reset the lamp counter as described in the User Interface documentation.
- Turn the lamp ON.
- Give the lamp more than 10 minutes to warm-up.
- Perform "Wavelength Verification/Calibration" on page 118 to check the correct positioning of the lamp.

4 Replace the bracket and fix the cuvette.



5 Install the cuvette holder in the instrument.

Next steps:

- Perform your verification.

Correcting Leaks

When required	If a leakage has occurred in the flow cell area or at the capillary connections.
Tools required	Tissue Two 1/4 inch wrenches for capillary connections
Parts required	None

1 Remove the front cover.

2 Use tissue to dry the leak sensor area.

3 Observe the capillary connections and the flow cell area for leaks and correct, if required.

4 Replace the front cover.

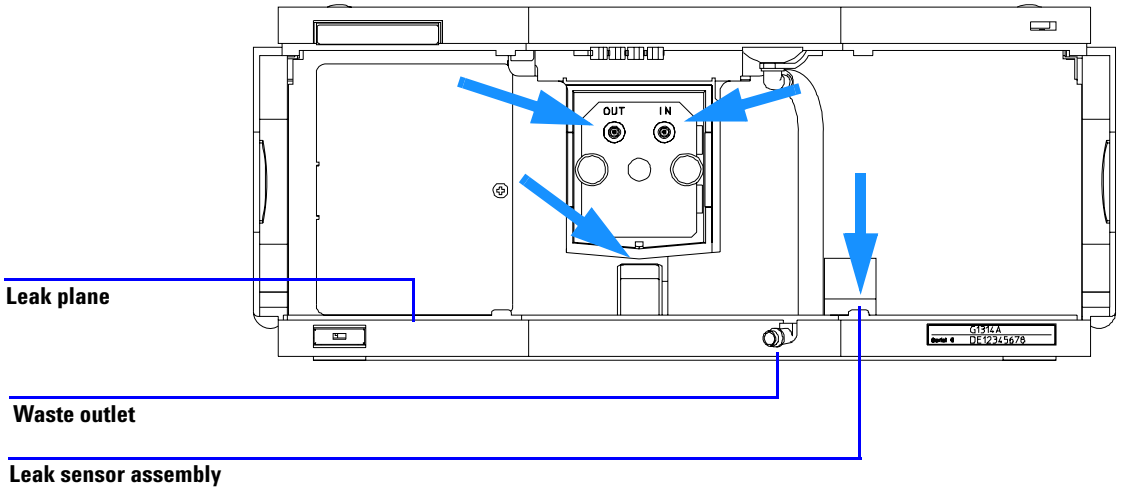


Figure 48 Drying the Leak Sensor

Replacing Leak Handling System Parts

When required	If the parts are corroded or broken.
Tools required	None
Parts required	Leak funnel 5061-3356 Leak funnel holder 5041-8389 Leak tubing (120 mm) 0890-1711

1 Remove the front cover to have access to the leak handling system.
2 Pull the leak funnel out of the leak funnel holder.
3 Pull the leak funnel with the tubing out of its location.
4 Replace the leak funnel and/or the tubing.
5 Insert the leak funnel with the tubing in its position.
6 Insert the leak funnel into the leak funnel holder.
7 Replace the front cover.

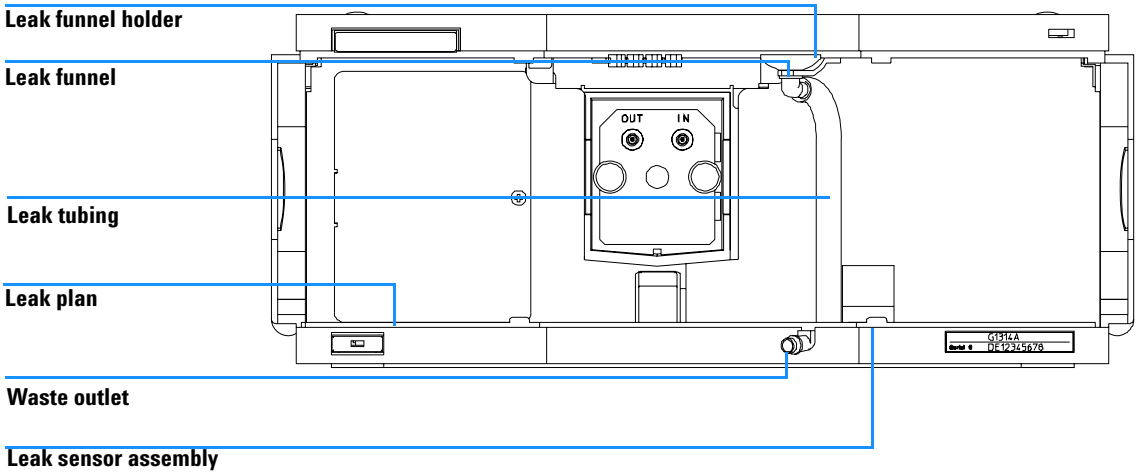
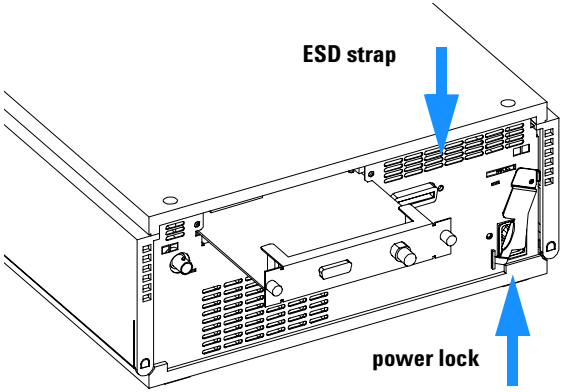


Figure 49 Replacing Waste Handling System Parts

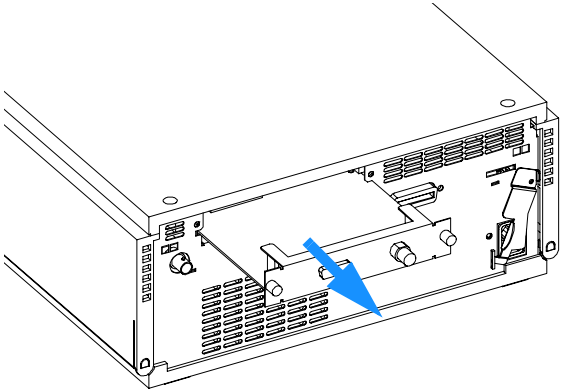
Replacing the Interface Board

When required	When defective or for installation of the board or for all repairs inside the detector.
Part required	Interface board (BCD) G1351-68701 with external contacts and BCD outputs, see chapter "*Hardware Information in the Service Manual* ". LAN Communication Interface board G1369B or G1369-60002, see chapter "*Hardware Information in the Service Manual* ".
Tools required	None

1 Install the ESD strap. Move the power lock across the power inlet.



2 If required, unscrew and remove the interface board. Place the board on the ESD kit.



3 If required, insert the interface board and fix the screws.

Next steps:

- Remove the ESD strap.
- Reinstall the module into the stack.

Replacing the Detector's Firmware

When required	
	The installation of newer firmware might be necessary • if a newer version solves problems of older versions or • to keep all systems on the same (validated) revision.
	The installation of older firmware might be necessary • to keep all systems on the same (validated) revision or • if a new module with newer firmware is added to a system or • if third part control software requires a special version.
Tools required	• LAN/RS-232 Firmware Update Tool, or • Agilent Diagnostic Software Instant Pilot G4208A
Parts required	Firmware, tools and documentation from Agilent web site
Preparations	Read update documentation provided with the Firmware Update Tool.

To upgrade/downgrade the module's firmware carry out the following steps:

1 Download the required module firmware, the latest LAN/RS-232 FW Update Tool and the documentation from the Agilent web.
   - http://www.chem.agilent.com/scripts/cag_firmware.asp.

2 To load the firmware into the module follow the instructions in the documentation.

Module Specific Information

Table 26 Module Specific Information

	G1314B	G1314C
Initial firmware	A.06.02	A.06.02
Compatibility with 1100 / 1200 series modules	yes, all modules should have the firmware from the same set.	
Conversion to / emulation of G1314A or G1314B	possible, if required	

11
Parts and Materials for Maintenance

Overview of Maintenance Parts 160
Standard Flow Cell 161
Micro Flow Cell 162
Semi-micro Flow Cell 163
High Pressure Flow Cell 165
Cuvette Holder 166
Leak Parts 167
Accessory Kit 168

This chapter provides information on parts for maintenance.

Overview of Maintenance Parts

Table 27 Maintenance Parts

Item	Description	Part Number
	Cable CAN assembly 0.5 m	5181-1516
	Cable CAN assembly 1 m	5181-1519
	Interface board BCD/External Contacts	G1351-68701
	LAN Communication Interface board	G1369B or G1369-60002
	Instant Pilot G4208A	G4208-67001
	Deuterium lamp	G1314-60100
	Standard flow cell, 10 mm 14 µL, additional flow cell parts, see page 161	G1314-60086
	Micro flow cell, 5 mm 1 µL, additional flow cell parts, see page 162	G1314-60081
	High pressure flow cell, 10 mm 14 µL, additional flow cell parts, see page 165	G1314-60082
	Semi-micro flow cell, 6 mm 5 µL, additional flow cell parts, see page 163	G1314-60083
	Cuvette Holder	G1314-60200
	Front cover	5067-4691
	Leak handling parts	see page 167

Standard Flow Cell

Table 28 Standard Flow Cell Assembly

Item	Description	Part Number
	Standard Flow Cell, 10 mm, 14 µL, 40 bar	G1314-60086
1	Cell screw kit, quantity=2	G1314-65062
2	Conical spring kit, quantity=10	79853-29100
3	Ring #1 PEEK kit, quantity=2	G1314-65065
4	Gasket #1 (small hole), KAPTON, quantity=10	G1314-65063
5	Window quartz kit, quantity=2	79853-68742
6	Gasket #2 (large hole), KAPTON, quantity=10	G1314-65064
7	Ring #2 PEEK kit, quantity=2	G1314-65066

1 - Cell Screw
2 - Conical Springs
3 - Ring #1 PEEK
4 - Gasket #1 (small hole)
5 - Window Quartz
6 - Gasket #2 (large hole)
7 - Ring #2 PEEK

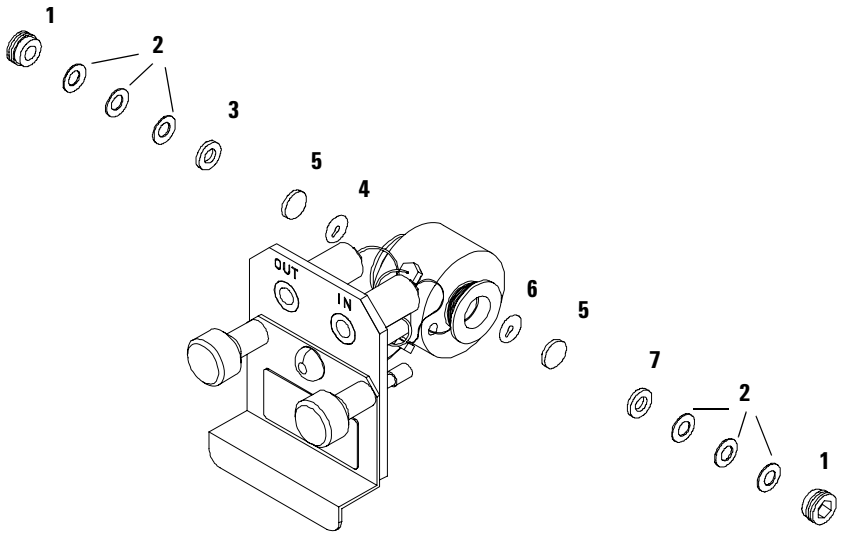


Figure 50 Standard Flow Cell

Micro Flow Cell

Table 29 Micro Flow Cell Assembly

Item	Description	Part Number
	Micro flow cell, 5 mm, 1 µL, 40 bar	G1314-60081
	Capillary column – detector SST 400 mm lg, 0.12 i.d.	5021-1823
1	Cell screw	79853-27200
	Cell kit micro, comprises: two windows, two gaskets #1 and two gaskets #2	G1314-65052
2	Conical spring kit, quantity=10	79853-29100
3	Ring SST kit, quantity=2	79853-22500
4	Window quartz kit, quantity=2	79853-68742
5	Gasket #1, PTFE, quantity=10	79853-68743
6	Gasket #2, PTFE, quantity=10	G1314-65053

1 - Cell Screw

2 - Conical Springs

3 - Ring SST

4 - Gasket #1

5 - Window Quartz

6 - Gasket #2

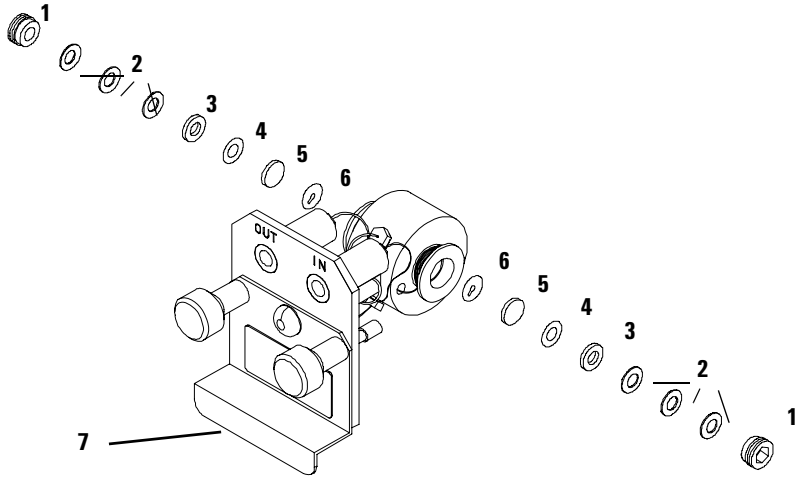


Figure 51 Micro Flow Cell

Semi-micro Flow Cell

Table 30 Semi-micro Flow Cell Assembly

Item	Description	Part Number
	Semi-micro flow cell assembly, 6 mm, 5 µL, 40 bar	G1314-60083
1	Cell screw	79853-27200
	Semi-micro cell kit, consisting of: two windows, two #1 standard gaskets, one #1 semi-micro gasket and one #2 semi-micro gasket.	G1314-65056
2	Conical springs, (pack of 10)	79853-29100
3	Ring SST, (pack of 2)	79853-22500
4	PTFE #1 standard gasket, (pack of 10)	79853-68743
5	Quartz window, (pack of 2)	79853-68742
6	Semi-micro #1 gasket, PTFE, (pack of 10)	G1314-65057
7	Semi-micro #2 gasket, PTFE, (pack of 10)	G1314-65058
	Inlet capillary, 400 mm long, 0.12 mm i.d.	5021-1823

NOTE The semi-micro #1 and #2 gaskets (items 6 and 7) look very similar. Do not mix them up

1 - Cell screw
2 - Conical springs
3 - Ring SST
4 - Gasket #1
5 - Quartz window
6 - Semi-micro gasket #1
7 - Semi-micro gasket #2

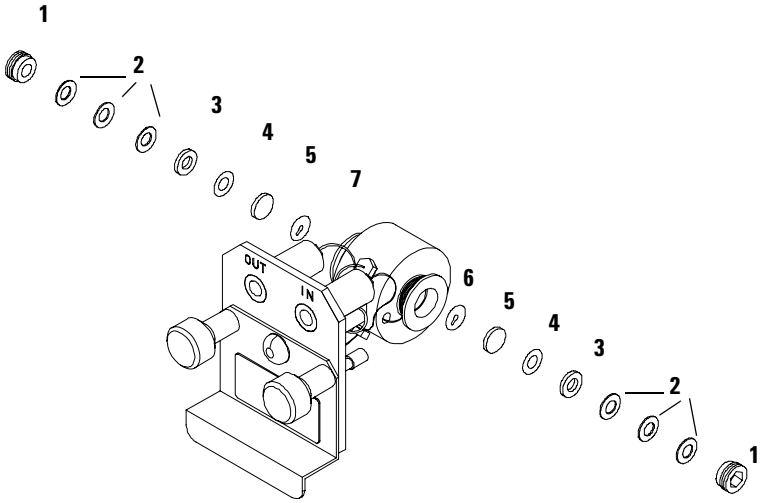


Figure 52 Semi-micro Flow Cell

High Pressure Flow Cell

Table 31 High Pressure Flow Cell Assembly

Item	Description	Part Number
	High pressure flow cell, 10 mm, 14 µL, 400 bar	G1314-60082
	Capillary column–detector SST 380 mm lg, 0.17 i.d. (one side not assembled)	G1315-87311
1	Cell screw	79853-27200
	Cell kit Agilent, comprises: two windows, two KAPTON gaskets and two PEEK rings	G1314-65054
2	Ring PEEK kit, quantity=2	79853-68739
3	Window quartz kit, quantity=2	79853-68734
4	Gasket kit, KAPTON, quantity=10	G1314-65055

1 - Cell screw

2 - Ring PEEK

3 - Window quartz

4 - Gasket KAPTON

5 - Cell Cover

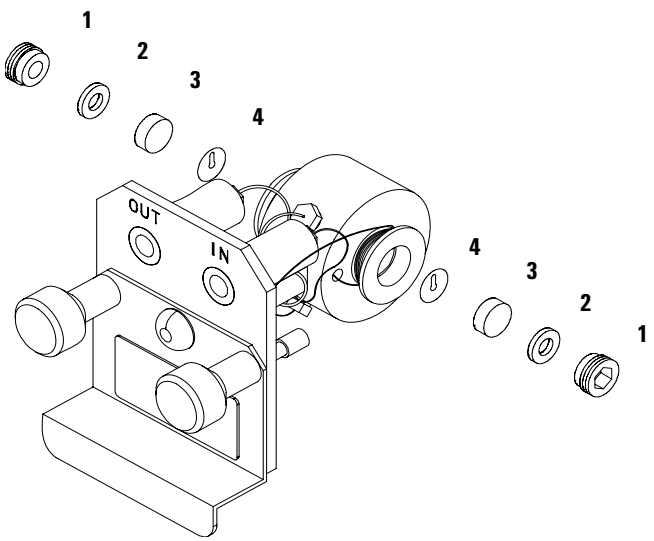


Figure 53 High Pressure Flow Cell

Cuvette Holder

Table 32 Cuvette Holder

Item	Description	Part Number
	Cuvette Holder	G1314-60200

For information the use of the cuvette holder, refer to “Using the Cuvette Holder" on page 151.

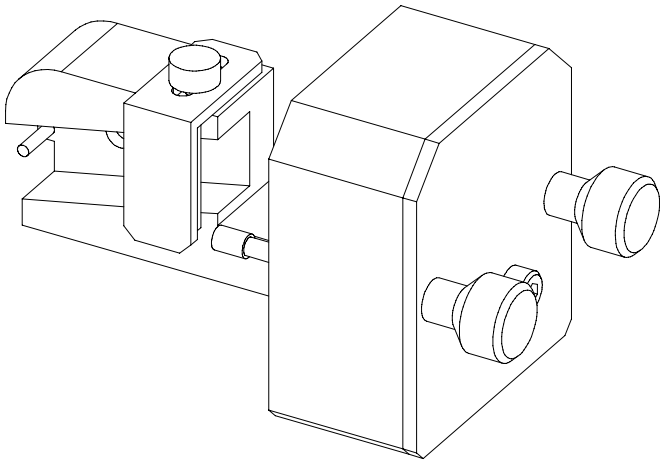


Figure 54 Cuvette Holder

Leak Parts

Table 33 Leak Parts

Item	Description	Part Number
3	Leak funnel	5041-8388
4	Leak funnel holder	5041-8389
5	Clip	5041-8387
6, 7	Corrugated tubing, 1200 mm lg, re-order 5 m	5062-2463

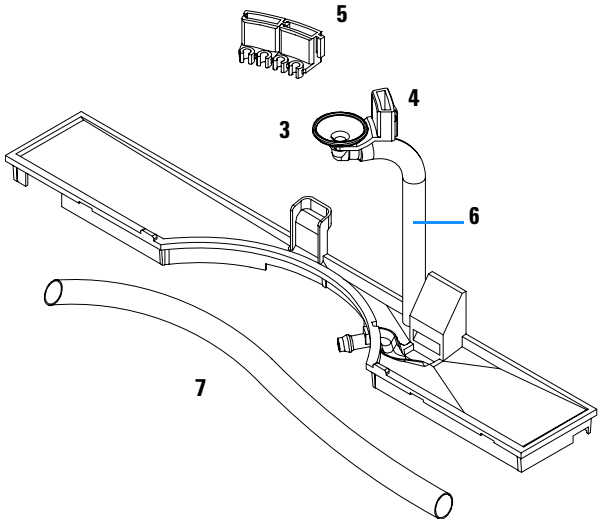


Figure 55 Leak Parts

Accessory Kit

This kit contains some accessories and tools needed for the installation and repair of the detector.

Table 34 Accessory Kit Parts

Description	Part Number
Accessory kit	G1314-68755
Corrugated tubing (to waste), re-order 5 m	5062-2463
Peek outlet capillary kit, i.d. is 0.25 mm (PEEK)	5062-8535
Fitting male PEEK 2/pk	0100-1516

12
Identifying Cables

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CAN / LAN Cables 181
RS-232 Cable 182
External Contact Cable 183

This chapter provides information on cables used with the Agilent 1260 Infinity modules.

Cable Overview

NOTE Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.

Analog cables

p/n	Description
35900-60750	Agilent module to 3394/6 integrators
35900-60750	Agilent 35900A A/D converter
01046-60105	Analog cable (BNC to general purpose, spade lugs)

Remote cables

p/n	Description
03394-60600	Agilent module to 3396A Series I integrators
	3396 Series II / 3395A integrator, see details in section "Agilent module to 3396 Series II / 3395A Integrators" on page 176
03396-61010	Agilent module to 3396 Series III / 3395B integrators
5061-3378	Agilent module to Agilent 35900 A/D converters (or HP 1050/1046A/1049A)
01046-60201	Agilent module to general purpose

BCD cables

p/n	Description
03396-60560	Agilent module to 3396 integrators
G1351-81600	Agilent module to general purpose

CAN cables

p/n	Description
5181-1516	CAN cable, Agilent module to module, 0.5 m
5181-1519	CAN cable, Agilent module to module, 1 m

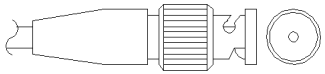
LAN cables

p/n	Description
5023-0203	Cross-over network cable, shielded, 3 m (for point to point connection)
5023-0202	Twisted pair network cable, shielded, 7 m (for point to point connection)

RS-232 cables

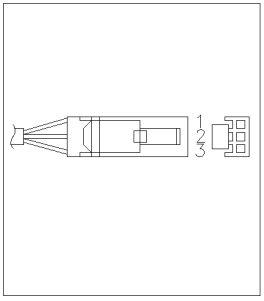
p/n	Description
G1530-60600	RS-232 cable, 2 m
RS232-61600	RS-232 cable, 2.5 m Instrument to PC, 9-to-9 pin (female). This cable has special pin-out, and is not compatible with connecting printers and plotters. It's also called "Null Modem Cable" with full handshaking where the wiring is made between pins 1-1, 2-3, 3-2, 4-6, 5-5, 6-4, 7-8, 8-7, 9-9.
5181-1561	RS-232 cable, 8 m

Analog Cables

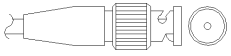


One end of these cables provides a BNC connector to be connected to Agilent 1260 Infinity modules. The other end depends on the instrument to which connection is being made.

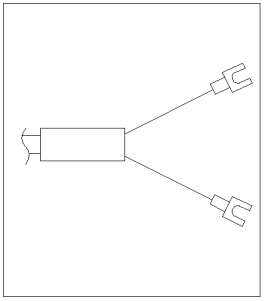
Agilent Module to 3394/6 Integrators

p/n 35900-60750	Pin 3394/6	Pin Agilent module	Signal name
	1		Not connected
	2	Shield	Analog -
	3	Center	Analog +

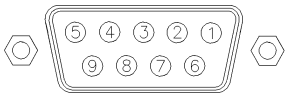
Agilent Module to BNC Connector

p/n 8120-1840	Pin BNC	Pin Agilent module	Signal name
	Shield	Shield	Analog -
	Center	Center	Analog +

Agilent Module to General Purpose

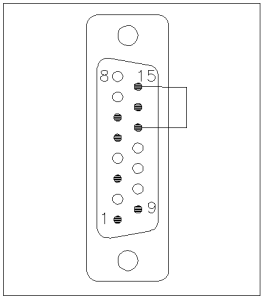
p/n 01046-60105	Pin 3394/6	Pin Agilent module	Signal name
	1		Not connected
	2	Black	Analog -
	3	Red	Analog +

Remote Cables



One end of these cables provides a Agilent Technologies APG (Analytical Products Group) remote connector to be connected to Agilent 1260 Infinity modules. The other end depends on the instrument to be connected to.

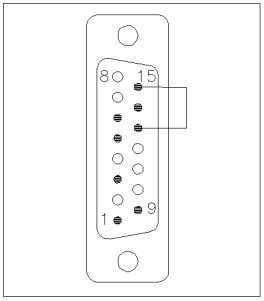
Agilent Module to 3396A Integrators

p/n 03394-60600	Pin 3394	Pin Agilent module	Signal name	Active (TTL)
	9	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	3	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	5,14	7 - Red	Ready	High
	1	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low
	13, 15		Not connected	

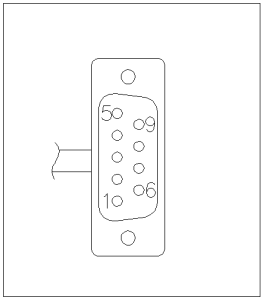
Agilent module to 3396 Series II / 3395A Integrators

Use the cable 03394-60600 and cut pin #5 on the integrator side. Otherwise the integrator prints START; not ready.

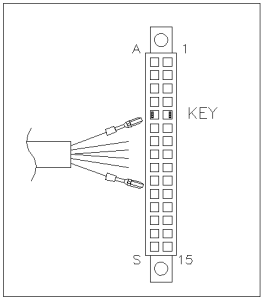
Agilent Module to 3396 Series III / 3395B Integrators

p/n 03396-61010	Pin 33XX	Pin Agilent module	Signal name	Active (TTL)
	9	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	3	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	14	7 - Red	Ready	High
	4	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low
	13, 15		Not connected	

Agilent Module to Agilent 35900 A/D Converters

p/n 5061-3378	Pin HP 1050 / ...	Pin Agilent module	Signal name	Active (TTL)
	1 - White	1 - White	Digital ground	
	2 - Brown	2 - Brown	Prepare run	Low
	3 - Gray	3 - Gray	Start	Low
	4 - Blue	4 - Blue	Shut down	Low
	5 - Pink	5 - Pink	Not connected	
	6 - Yellow	6 - Yellow	Power on	High
	7 - Red	7 - Red	Ready	High
	8 - Green	8 - Green	Stop	Low
	9 - Black	9 - Black	Start request	Low

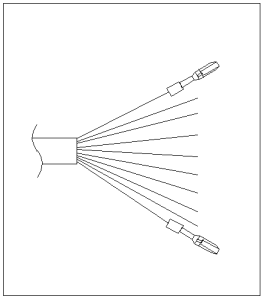
Agilent Module to General Purpose

p/n 01046-60201	Pin Universal	Pin Agilent module	Signal name	Active (TTL)
		1 - White	Digital ground	
		2 - Brown	Prepare run	Low
		3 - Gray	Start	Low
		4 - Blue	Shut down	Low
		5 - Pink	Not connected	
		6 - Yellow	Power on	High
		7 - Red	Ready	High
		8 - Green	Stop	Low
		9 - Black	Start request	Low

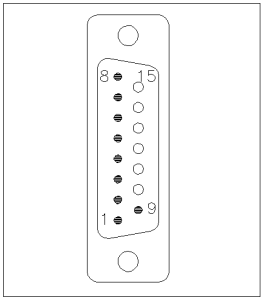
BCD Cables

One end of these cables provides a 15-pin BCD connector to be connected to the Agilent 1260 Infinity modules. The other end depends on the instrument to be connected to

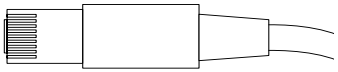
Agilent Module to General Purpose

p/n G1351-81600	Wire Color	Pin Agilent module	Signal name	BCD Digit
	Green	1	BCD 5	20
	Violet	2	BCD 7	80
	Blue	3	BCD 6	40
	Yellow	4	BCD 4	10
	Black	5	BCD 0	1
	Orange	6	BCD 3	8
	Red	7	BCD 2	4
	Brown	8	BCD 1	2
	Gray	9	Digital ground	Gray
	Gray/pink	10	BCD 11	800
	Red/blue	11	BCD 10	400
	White/green	12	BCD 9	200
	Brown/green	13	BCD 8	100
	not connected	14		
	not connected	15	+5 V	Low

Agilent Module to 3396 Integrators

p/n 03396-60560	Pin 3392/3	Pin Agilent module	Signal name	BCD Digit
	1	1	BCD 5	20
	2	2	BCD 7	80
	3	3	BCD 6	40
	4	4	BCD 4	10
	5	5	BCD0	1
	6	6	BCD 3	8
	7	7	BCD 2	4
	8	8	BCD 1	2
	9	9	Digital ground	
	NC	15	+ 5 V	Low

CAN / LAN Cables



Both ends of this cable provide a modular plug to be connected to Agilent 1260 Infinity module's CAN-bus connectors.

CAN Cables

p/n	Description
5181-1516	CAN cable, Agilent module to module, 0.5 m
5181-1519	CAN cable, Agilent module to module, 1 m

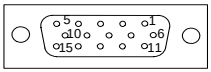
LAN Cables

p/n	Description
5023-0203	Cross-over network cable, shielded, 3 m (for point to point connection)
5023-0202	Twisted pair network cable, shielded, 7 m (for point to point connection)

RS-232 Cable

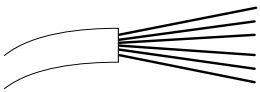
p/n	Description
G1530-60600	RS-232 cable, 2 m
RS232-61600	RS-232 cable, 2.5 m Instrument to PC, 9-to-9 pin (female). This cable has special pin-out, and is not compatible with connecting printers and plotters. It's also called "Null Modem Cable" with full handshaking where the wiring is made between pins 1-1, 2-3, 3-2, 4-6, 5-5, 6-4, 7-8, 8-7, 9-9.
5181-1561	RS-232 cable, 8 m

External Contact Cable



One end of this cable provides a 15-pin plug to be connected to Agilent 1260 Infinity module's interface board. The other end is for general purpose.

Agilent 1260 Infinity Interface Board to general purposes

p/n G1103-61611	Color	Pin Agilent module	Signal Name
	White	1	EXT 1
	Brown	2	EXT 1
	Green	3	EXT 2
	Yellow	4	EXT 2
	Grey	5	EXT 3
	Pink	6	EXT 3
	Blue	7	EXT 4
	Red	8	EXT 4
	Black	9	Not connected
	Violet	10	Not connected
	Grey/pink	11	Not connected
	Red/blue	12	Not connected
	White/green	13	Not connected
	Brown/green	14	Not connected
	White/yellow	15	Not connected

A
Appendix

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This chapter provides addition information on safety, legal and web.

General Safety Information

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

WARNING

Ensure the proper usage of the equipment.

The protection provided by the equipment may be impaired.

→ The operator of this instrument is advised to use the equipment in a manner as specified in this manual.

Safety Standards

This is a Safety Class I instrument (provided with terminal for protective earthing) and has been manufactured and tested according to international safety standards.

Operation

Before applying power, comply with the installation section. Additionally the following must be observed.

Do not remove instrument covers when operating. Before the instrument is switched on, all protective earth terminals, extension cords, auto-transformers, and devices connected to it must be connected to a protective earth via a ground socket. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in serious personal injury. Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any intended operation.

Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, and so on) are used for replacement. The use of repaired fuses and the short-circuiting of fuse holders must be avoided.

Some adjustments described in the manual, are made with power supplied to the instrument, and protective covers removed. Energy available at many points may, if contacted, result in personal injury.

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible. When inevitable, this should be carried out by a skilled person who is aware of the hazard involved. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present. Do not replace components with power cable connected.

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Do not install substitute parts or make any unauthorized modification to the instrument.

Capacitors inside the instrument may still be charged, even though the instrument has been disconnected from its source of supply. Dangerous voltages, capable of causing serious personal injury, are present in this instrument. Use extreme caution when handling, testing and adjusting.

When working with solvents please observe appropriate safety procedures (e.g. goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet by the solvent vendor, especially when toxic or hazardous solvents are used.

Safety Symbols

Table 35 shows safety symbols used on the instrument and in the manuals.

Table 35 Safety Symbols

Symbol	Description
	The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect the apparatus against damage.
	Indicates dangerous voltages.
	Indicates a protected ground terminal.
	Indicates eye damage may result from directly viewing the light produced by the deuterium lamp used in this product
	Indicates eye damage may result from directly viewing the light produced by the deuterium lamp used in this product.

WARNING

A WARNING

alerts you to situations that could cause physical injury or death.

→ Do not proceed beyond a warning until you have fully understood and met the indicated conditions.

CAUTION

A CAUTION

alerts you to situations that could cause loss of data, or damage of equipment.

→ Do not proceed beyond a caution until you have fully understood and met the indicated conditions.

Lithium Batteries Information

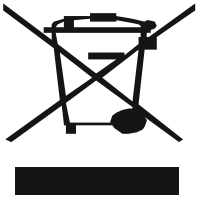
WARNING **Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the equipment manufacturer. Lithium batteries may not be disposed-off into the domestic waste.**

Transportation of discharged Lithium batteries through carriers regulated by IATA/ICAO, ADR, RID, IMDG is not allowed. Discharged Lithium batteries shall be disposed off locally according to national waste disposal regulations for batteries.

WARNING **Lithium batteri - Eksplosionsfare ved fejlagtig håndtering. Udskiftning må kun ske med batteri af samme fabrikat og type. Lever det brugte batteri tilbage til leverandøren.**

WARNING **Lithiumbatteri - Eksplosionsfare. Ved udskiftning benyttes kun batteri som anbefalt av apparatfabrikanten. Brukt batteri returneres appararleverandoren.**

NOTE Bij dit apparaat zijn batterijen geleverd. Wanneer deze leeg zijn, moet u ze niet weggooien maar inleveren als KCA.



Radio Interference

If test and measurement equipment is operated with unscreened cables, or used for measurements on open set-ups, the user has to assure that under operating conditions the radio interference limits are still met within the premises.

Test and Measurement

If test and measurement equipment is operated with unscreened cables, or used for measurements on open set-ups, the user has to assure that under operating conditions the radio interference limits are still met within the premises.

Sound Emission

Manufacturer's Declaration

This statement is provided to comply with the requirements of the German Sound Emission Directive of 18 January 1991.

This product has a sound pressure emission (at the operator position) < 70 dB.

- Sound Pressure Lp < 70 dB (A)
- At Operator Position
- Normal Operation
- According to ISO 7779:1988/EN 27779/1991 (Type Test)

UV-Radiation

Emissions of ultraviolet radiation (200-315 nm) from this product is limited such that radiant exposure incident upon the unprotected skin or eye of operator or service personnel is limited to the following TLVs (Threshold Limit Values) according to the American Conference of Governmental Industrial Hygienists:

Table 36 UV-Radiation Limits

Exposure/day	Effective Irradiance
8 hours	0.1 µW/cm^2
10 minutes	5.0 µW/cm^2

Typically the radiation values are much smaller than these limits:

Table 37 UV-Radiation Typical Values

Position	Effective Irradiance
Lamp installed, 50-cm distance	average 0.016 µW/cm^2
Lamp installed, 50-cm distance	maximum 0.14 µW/cm^2

Solvent Information

Observe the following recommendations on the use of solvents.

Flow Cell

Avoid the use of alkaline solutions (pH > 9.5) which can attack quartz and thus impair the optical properties of the flow cell.

Prevent any crystallization of buffer solutions. This will lead into a blockage/damage of the flow cell.

If the flow cell is transported while temperatures are below 5 degree C, it must be assured that the cell is filled with alcohol.

Aqueous solvents in the flow cell can built up algae. Therefore do not leave aqueous solvents sitting in the flow cell. Add small % of organic solvents (e.g. Acetonitrile or Methanol ~5%).

Solvents

Brown glass ware can avoid growth of algae.

Always filter solvents, small particles can permanently block the capillaries. Avoid the use of the following steel-corrosive solvents:

- Solutions of alkali halides and their respective acids (for example, lithium iodide, potassium chloride, and so on).
- High concentrations of inorganic acids like nitric acid, sulfuric acid especially at higher temperatures (replace, if your chromatography method allows, by phosphoric acid or phosphate buffer which are less corrosive against stainless steel).
- Halogenated solvents or mixtures which form radicals and/or acids, for example:

  $2CHCl_3 + O_2 \rightarrow 2COCl_2 + 2HCl$

  This reaction, in which stainless steel probably acts as a catalyst, occurs quickly with dried chloroform if the drying process removes the stabilizing alcohol.

- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropylether) such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides.
- Solutions of organic acids (acetic acid, formic acid, and so on) in organic solvents. For example, a 1-% solution of acetic acid in methanol will attack steel.
- Solutions containing strong complexing agents (for example, EDTA, ethylene diamine tetra-acetic acid).
- Mixtures of carbon tetrachloride with 2-propanol or THF.

Declaration of Conformity for HOX2 Filter

Declaration of Conformity

We herewith inform you that the

Holmium Oxide Glass Filter

used in Agilents absorbance detectors listed in the table below meets the requirements of National Institute of Standards and Technology (NIST) to be applied as certified wavelength standard.

According to the publication of NIST in J. Res. Natl. Inst. Stand. Technol. 112, 303-306 (2007) the holmium oxide glass filters are inherently stable with respect to the wavelength scale and need no recertification. The expanded uncertainty of the certified wavelength values is 0.2 nm.

Agilent Technologies guarantees, as required by NIST, that the material of the filters is holmium oxide glass representing the inherently existent holmium oxide absorption bands.

Test wavelengths:

Product Number	Series	Measured Wavelength *	Wavelength Accuracy	Optical Bandwidth
79883A	1090	361.0 nm 418.9 nm 453.7 nm 536.7 nm	+/- 1 nm	2 nm
79854A	1050			
G1306A	1050			
G1315A, G1365A	1100			
G1315B/C, G1365B/C	1100 / 1200 / 1260			
G1600A, G7100A	CE			
79853C	1050	360.8nm 418.5nm 536.4nm	+/- 2 nm	6 nm
G1314A/B/C G1314D/E/F	1100 / 1200 / 1260	360.8nm 418.5nm 536.4nm	+/- 1 nm	6 nm
G4286,..., 90A/B/C	1120 / 1220			

*) The variation in Measured Wavelength depends on the different Optical Bandwidth.

May 19, 2010

(Date)

(R&D Manager)

(Quality Manager)

P/N 89550-90501	Revision: H Effective by: May 19, 2010	Agilent Technologies

Agilent Technologies on Internet

For the latest information on products and services visit our worldwide web site on the Internet at:

http://www.agilent.com

Select “**Products**” - “**Chemical Analysis**”

It will provide also the latest firmware of the Agilent 1260 Infinity modules for download.

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In This Book

This manual contains the technical reference information about the Agilent 1260 Infinity Variable Wavelength Detector.

The manual describes the following:

- introcduction and specifications,
- installation,
- using and optimizing,
- troubleshooting and diagnose,
- maintenance,
- parts identification,
- safety and related information.

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